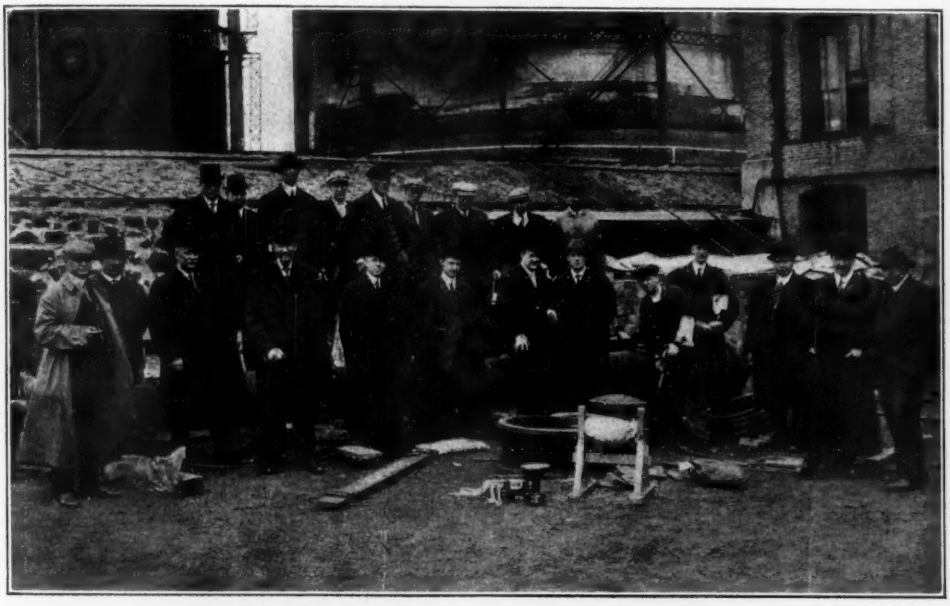
COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC.

Vol. XVIII JUNE, 1913 No. 6



A PNEUMATIC CALKING TEST.

PNEUMATIC CALKING OF GAS AND WATER MAINS

BY CHAS. DOUGHERTY.

The economical and efficient calking of gas and water mains has always been more or less of a problem to the contractor. To satisfy the requirements of a properly calked main involves a rather tedious and slow operation when performed by hand, and this is responsible for the greater share of delay attendant upon the laying of such pipe. In addition, it is expensive and lacks uniformity and reliability, which is most frequent on the under side of the pipe on account of its inaccessibility.

It has been demonstrated, time and time again, that such a joint calked by a pneumatic hammer, using lead wool, is not only a tighter, more satisfactory joint, but that the time and expense of calking it is cut in half, and at times even better performances than this have been obtained.

A practical test of pneumatic calking was recently conducted, in the presence of some 200 representatives of various gas and water companies from the vicinity of Boston. The test was held for the information of the Water Department of the City of Boston, in the yards of the Malden Gas Co., Malden, Mass., to determine the relative efficiency of a hand calked and a pneumatically calked joint for high pres-

sure water service, some 15 miles of such high pressure pipe being required to be laid for the Fire Department of the City of Boston. These mains in service will be under a continuous hydrostatic pressure of 300 lbs.

A hub and cap, with a special double groove high pressure joint, was provided by the Water Department for pneumatic calking against time. The demonstrator of the Ingersoll-Rand Company first yarned the joint with about 1½-inch of hemp rope, the remainder of the space being filled with lead wool and calked, strand by strand, in a total elapsed time of two hours. This included the preparation of the yarn and the lead wool for insertion in the joint. The hammer used was a Crown 53-H Calking Hammer, using a calking iron with a round shank.

The record made is a revelation, as compared with the calking of a similar joint by hand. Past records show that with two men it required an average of two days, of eight hours each, to complete such a joint, making about 32 man-hours by hand.

After the calking had been completed, the joint was submitted to a test, under the direct supervision of the Water Department. Calibrations were made at different pressures, so as to determine the expansion of the joint under varying conditions, up to a point when it showed a tendency to pull away. Up to a pressure of 600 lbs. there was no leak apparent, although the joint had spread considerably, about 15-1000 of an inch. The test for tightness shows up very much in favor of the pneumatically calked joint, as similar joints made with cast lead, and calked by hand would raise as much as 1⅜-inches under a pressure of 600 lbs.

The above mentioned test was conducted under rather adverse conditions. In the first place the hammer used had been in service a number of years. In addition the calking irons provided were not of just the right size or shape for the special joint under test, and as a result a great deal of time was lost.

The results of this test show conclusively that the pneumatic calking process is faster and at the same time gives a joint superior to the hand calked one using lead wool, that it is also far superior to poured lead joints whether hand or pneumatically calked, and that it can be used in all situations likely to occur in practice.

AN AIR COMPRESSOR OIL CONSUMPTION RECORD

It is reported that a compressor which has been running at the power house of the Nevada Consolidated Copper Co., 24 hours per day for the last five years is compressing 16,000,000 cu. ft. of free air per gallon of lubricating, and without bad effects on the machine.

This is an excellent record and is worth looking into a little. A compressor with an intake cylinder 24 in. diameter, which is quite a common size, and a piston speed of 400 ft. per min., will compress, say, 1,200 cu. ft. of free air per minute, or 1,728,000 cu. ft. per 24 hours. Then the oil used per day, at the rate of consumption given in the above paragraph, would be only 0.108 gallon, or less than a pint for the 24 hours.

In COMPRESSED AIR MAGAZINE, September, 1911, a report of a month's running of the air compressors on the Panama Canal showed that at Rio Grande a gallon of lubricating oil was used for 3,360,124 cu. ft. of free air compressed; at Empire for 4,317,716 cu. ft.; and at Las Cascadas for 5,163,936 cu. ft., the Nevada oil consumption being less than one-third of the best of these.

THE ENERGY OF EXPLOSIVES

All commercial explosives owe their power of doing work to the expansive force of the great volume of gas into which they are converted at the occurrence of the explosion. The pressure exerted by this gas in the drill hole or other confined space in which the explosion is brought about is what makes explosive substances of value in mining or other industries, and is the primary cause of all those manifestations of energy that follow the firing of a charge. Common black blasting powder, on explosion, produces about 390 times its own volume of permanent gases; 40 per cent. dynamite produces about 530 times its own volume of permanent gases; and nitroglycerin produces somewhat more than 747 times its own volume of permanent gases. These proportions of volume of gases to volume of explosive are those that would be found if the gases were measured under normal conditions of temperature and pressure, but at the moment of explosion the gases are highly heated, and therefore tend to occupy a volume much greater than the figures given.

COMPRESSED AIR AND PNEUMATIC TOOLS IN THE FOUNDRY

BY W. H. ARMSTRONG.*

The first and most important thing to be determined in a compressed air installation is the compressor itself, and the first thing to be considered is the capacity of the machine. The average jobbing foundry requires a compressor of 300 to 500 cu. ft. per min., piston displacement. Large foundries may use up to 1,500 to 2,500 cu. ft. per min., and in such cases it is well to install two machines of different capacities, so that either machine may be used separately or both together, according to the changing air requirements. Novelty foundries usually require small machines of 50 to 100 cu. ft. piston displacement.

Whoever is installing a compressor for shop use should remember that more air is required this year than last year, and that still more will be called for next year, because more compressed air apparatus will be in use.

The compressor is ultimately responsible for the constant and steady operating of all the pneumatic tools and apparatus, so that care and judgment should be used in its selection. The drive of the machine will be determined by the type of power available. Steam, electricity or motor power, either applied direct, or by belt, chain or otherwise can all be made to give satisfactory service. The machine should be as nearly dirt proof, foot proof and automatic as possible. Compressors that would give perfect satisfaction when operated in connection with a general power plant and in charge of skilled engineers frequently "go to pieces" when installed alone in a foundry.

THE AIR HOIST.

Of the various pneumatic apparatus in the foundry it may perhaps be proper to speak first of the air hoist, as that is used in so many places and for such a variety of service throughout the works. It is used for unloading and distributing the incoming material and for loading the finished product when it goes out. It is valuable in conveying flasks in both directions between the foundry floor and the storage sheds; patterns to and from the pattern shop, or cleaned castings to the machine shop; for lifting copes or drawing

FIG. 1. IMPERIAL MOTOR HOIST.

patterns; conveying cores to ovens, for operating cupola elevators and core oven doors; for handling ladles before, during and after pouring, and lifting and conveying the castings from the pouring to the cleansing floor and then to the machine shop or elsewhere.

The most common types of air hoists are simple cylinders lifting direct or horizontal cylinders with or without multiplying shieves to reduce the length. The motor geared type of hoist is being largely adopted for much of the service where the single cylinders have been used, and especially for heavy traveling on jib cranes. Hoists of either type may often be applied to hand power cranes already in use without in the least interfering with the existing gearing, and at small expense. In the air hoist the power is applied to the load in the most direct and simplest manner. With this aid a boy can lift a given load a dozen times while a gang of men would be operating a chain block or a windlass. There is no noise, no jar and the load is always sustained. In foundries where an overhead traveler cannot be installed, air hoists suspended from trollys running on a track are very satisfactory.

*Abstract of a paper before the Philadelphia Foundrymen's Association, Hotel Walton, Philadelphia, Pa.

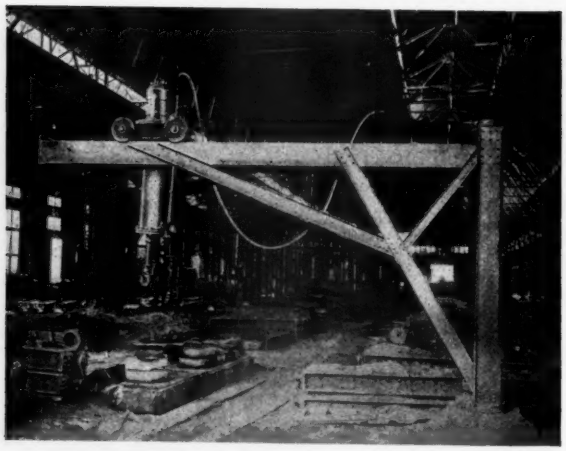


FIG. 2. AIR LIFT ON FOUNDRY CRANE.

COST OF AIR HOISTING.

Few realize how cheaply an air hoist is operated, besides its convenience and speed in handling loads. The following table compiled by Frank Richards requires no explanation.

Diam of cyl.	Effective area of piston.	Maximum weight lifted.	Cu. ft. of free air per 4-ft. lift.	Cost of air per 100 lifts.
2	3.05	274	0.74	$0.0037
3	6.87	618	1.67	.0084
4	12.22	1099	2.97	.0149
5	19.09	1718	4.64	.0232
6	27.49	2444	6.68	.0334
7	37.42	3367	9.09	.0455
8	48.87	4398	11.88	.0594
9	61.85	5566	15.03	.0752
10	76.36	6872	18.56	.0928
11	92.39	8315	22.46	.1123
12	109.96	9896	26.73	1337

COST OF PNEUMATIC HOISTING.

He estimates as the basis of the table that compressed air can be furnished for industrial purposes at 100 lbs. pressure at a cost of 5 cents per 1,000 cu. ft. of free air. It appears from this table that a hoist with a cylinder 6 in. diameter, with a piston rod 1 in. diameter and a lift of 4 ft., using air at 90 lb. pressure and allowing 30 per cent. additional to cover all contingencies, including the taking up of the slack of the hoisting chain, will lift more than a ton to a height of 4 ft. at a cost of $0.00035. A hundred of such lifts will thus be made, of course, for $0.035, or three and a half cents.

MOLDING MACHINES.

The molding machine now holds a prominent and most important position among labor saving devices in the foundry, increasing the output and improving the grade of the products. At first there was much opposition on the part of skilled molders to the adoption of these machines, and they were looked upon as luxuries where first successfully employed; but now they have a permanent place among the necessities.

The molding machine is equally well operated either by the fully skilled workman or by the ordinary laborer. The necessity of economy imposed upon foundry managers in all lines of work make imperative the adoption of labor-saving molding machines. Practically every line of casting can now be economically and successfully molded on either power or hand machines. The range has been broadened to meet every modern condition of foundry practice, and the installation of the molding machine in a specific case is merely a question of type and of the local conditions to be met. The degree of efficiency and the speed of operation depend upon the selection of the proper machine, and then upon the personality of the operator. Molding machines are so designed as to be operated with air at a pressure of 60 to 80 lb.

THE SAND RAMMER.

The sand rammer seems to come next in the order of consideration among the pneumatic tools of the foundry. Due to the marked improvements that have been made in the construction of this device, which tend to lessen the shock on the operator, and the education of the operators in the proper way to handle them, it has made a permanent place for itself, even against strong opposition, on the grounds of economy, lower production cost, larger output and improved quality of product which follow its use, and the adoption has become more general.

The pneumatic rammer does much more than merely to supply the power for the work. It

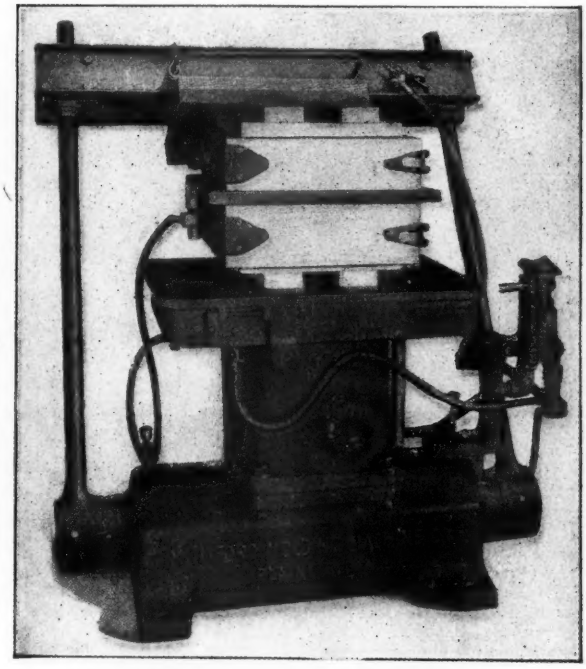


FIG. 3. PLAIN POWER SQUEEZER.

also changes the character of the ramming and gives the operator a variety of execution in the ramming which his muscles, at the best, could not command. The force, the direction, and especially the rapidity of the blows are so completely under the control of the operator that we might compare the manipulation of the rammer to the playing of a musical instrument. It relieves the moulder of the most fatiguing detail of his work.

In discussing recently the question of pneumatic sand rammers with the superintendent of one of the best organized and most representative foundries in this country, he made the following comments:

The pneumatic sand rammer for foundry work has demonstrated that it is one of the greatest friends and labor savers of the progressive foundryman today. When the sand rammer was first introduced there was some criticism concerning it, mainly arising from the natural antipathy mechanics have for anything in the machine line; but as the operators became familiar with its use and recognized its

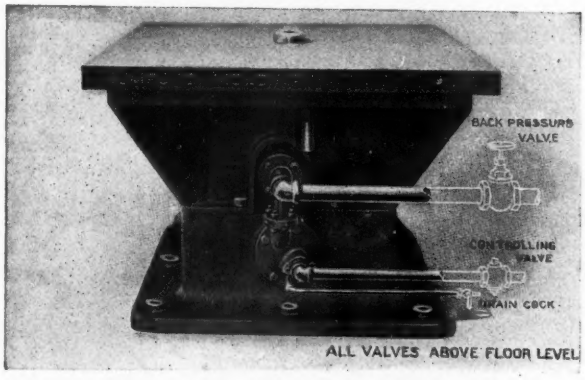


FIG. 4. JOLT RAMMER.

FIG. 5. BENCH RAMMER.

effectiveness, this feeling rapidly disappeared. Today in our foundry the men take kindly to these rammers, and use them entirely for work of every description.

Some writers claim that, while sand rammers are valuable for ramming drags, they cannot be used successfully on copes. We have exploded this contention completely in our shop and use the rammers on both copes and drags indiscriminately and with equal success.

The sand rammer is often put up against the jarring machine, and many claim that with the introduction of jolt machines the efficiency of the sand rammer is materially diminished. We have not found this to be the case. For medium size work that is made in quantities, we believe the jolt machine to be indispensable; even with this, however, the rammer is a very important factor in butting off the tops of the jolt ram and molds. When larger patterns are rammed, such as engine beds, sole plates, sub bases, etc., it has been our experience that the sand rammer is equal, if not superior, to the jolt machine.

This statement is made after taking into consideration the expense and labor incident to rigging up a pattern for use on a jolt machine, the tendency the mold has to sag upon being rolled over, the bolting on the plates before rolling the drag, and such other details as are encountered in rolling over a large job. On the other hand, if the pattern is bedded in the ground or flask, and rammed up with pneumatic rammers, which may be done with unskilled help, much of the expense and delay is eliminated, while we are sure of a perfectly true job, comforming to every detail of the pattern.

The pneumatic bench rammer is a very handy tool as an auxiliaray to the larger rammer. This rammer is very satisfactory for ramming a shelving pattern where the construction is such that it is difficult to ram under it with the larger tool. We find the bench rammer practically indispensable for work of this nature.

Speaking generally, it is my opinion that the sand rammer has increased our efficiency in

Size of Cope.	Time in Peining and Ramming. By Hand.	By Sand Rammer	Time Saved, Per cent.
12 ft. x 18 in. x 4 in	5 min.	1 min.	80
12 ft. x 18 in. x 10 in.	10 "	1½ "	85
6 ft. x 3 ft. x 6 in.	20 "	3 "	85
6 ft. x 6 ft. x 8 in.	35 "	8 "	77
8 ft. x 6 in. x 6 in.	1 hour	10 "	83
7 ft. x 3 ft. x 12 in.	1 " 30 min.	16 "	82
15 ft. x 30 in. x 16 in.	2 hours	27 "	77
12 ft. x 7 ft. x 16 in.	2 " 12 "	34 "	74
87 in. x 159 in. x 10 in.	4 "	40 "	83
19 ft x 90 in. x 15 in.	8 "	1 hour 30 min.	81

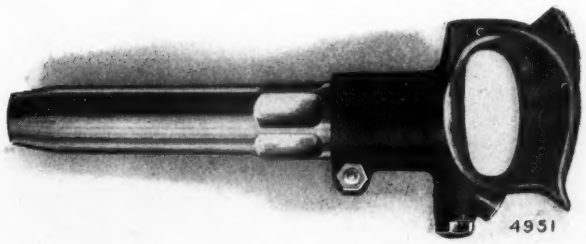


FIG. 6. IMPERIAL CHIPPING HAMMER.

this line fully four or five times, and since we have had them installed we would regret very much to be obliged to go back to the old way of ramming.

PNEUMATIC HAMMERS, DRILLS, ETC.

The value of the pneumatic chipping hammer in a foundry, as a saver of time and labor, is so universally conceded that the time has passed when it is deemed necessary to submit comparative figures, especially as much depends upon the conditions of operation and efficiency of the air plant. But suffice it to say that for all classes of chipping in foundry work, such as chipping fins off castings, cutting gates, risers, buttons off anchors, and general trimming, one man with one hammer of the proper size will do as much work as three or four men chipping by hand. These tools are made in different sizes, with piston strokes of 1 to 5 in., to meet different conditions. It is important that the proper size tool should be selected for the work, to insure the best results, the short stroke tools begin intended for the lighter work, requiring a light and very rapid blow, the longer stroke tools for the heavier work, requiring a heavy and slower blow. The medium sizes, with 2 and 3 in. piston stroke, are the sizes most generally used for foundry work.

The rotating air drill is another very familiar labor-saving device, though its field of usefulness in a foundry is somewhat limited. It is more particularly a general shop tool, possessing a very wide range for drilling, reaming, tapping, flue rolling, running in stay bolts, studs, and other applications seemingly limitless. It has established itself next to the pneumatic hammer as a most generally used air tool.

Like the other pneumatic devices for foundry use the sand sifter also proves to be a time and labor and cost saver. It is made in different styles which it is not necessary to describe. The saving effected has been figured out as follows:

Including the cost of air, based on an efficient compressor installation, and figuring generally at 3c. per hour for maintenance of

FIG. 7. CHIPPING A CASTING.

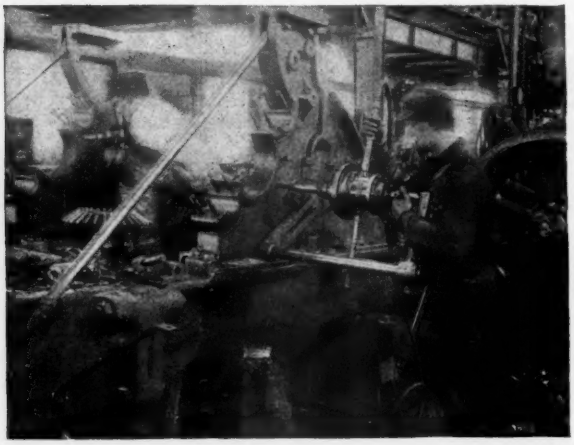


FIG. 8. IMPERIAL MOTOR DRILL.

sifter, compressor, pipe line, hose couplings, etc., and also including labor at 15c. per hour, the cost would be 27c. per hour. When you consider that one man with one machine will screen in one hour as much sand as a man would riddle by hand in one day, and basing his time at $1.50 per day, you will see that you effect by the use of the machine a saving of $1.23 in one hour.

The air torch has been found a great time and labor saver, being used for skin-drying copes, molds, etc., for heating ladles, lighting cupolas and in casting repairing processes.

The air nozzle for blowing blacking on molds, cores, etc., is also a universal favorite. This device is in the shape of a T, made of about ½ in. pipe with the discharge end bushed to about ¼ in. The air is connected so as to cross the top of the T. A short section of hose which goes to the receptacle holding the blacking is connected to the stem of the T, and as the air is blown through the top of the T it siphons the blacking and blows it in a spray over the work, reaching and covering every corner and crevice.

CLEANING CASTINGS—THE SAND BLAST.

There is hardly an operation of the foundry of greater importance, and which contributes more to a satisfactory factory product, than the proper and thorough cleaning of castings.

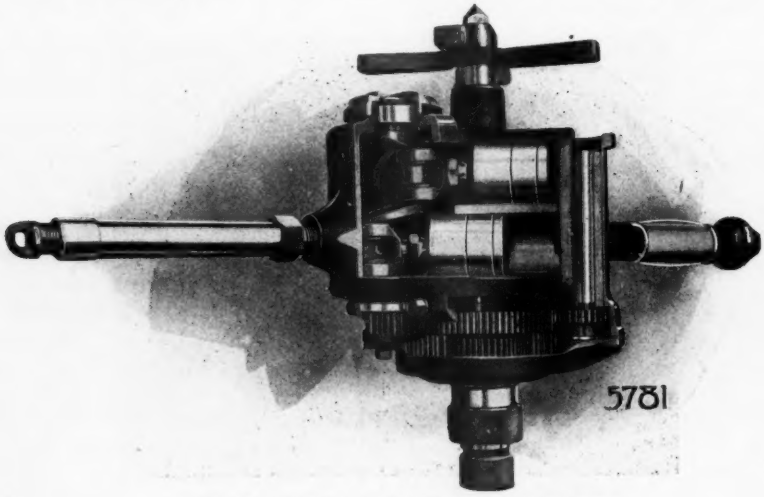


FIG. 9. SECTION OF IMPERIAL PISTON DRILL.

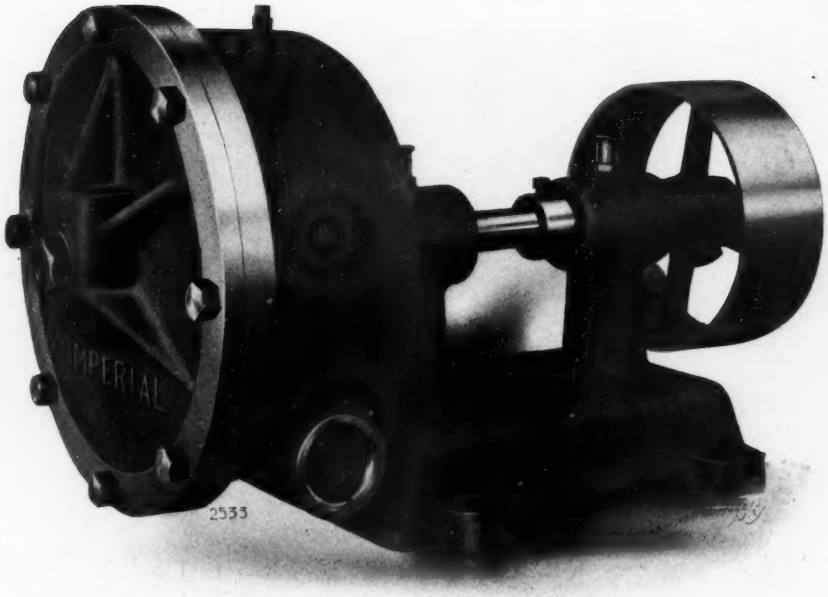


FIG. 11. STATIONARY AIR MOTOR.

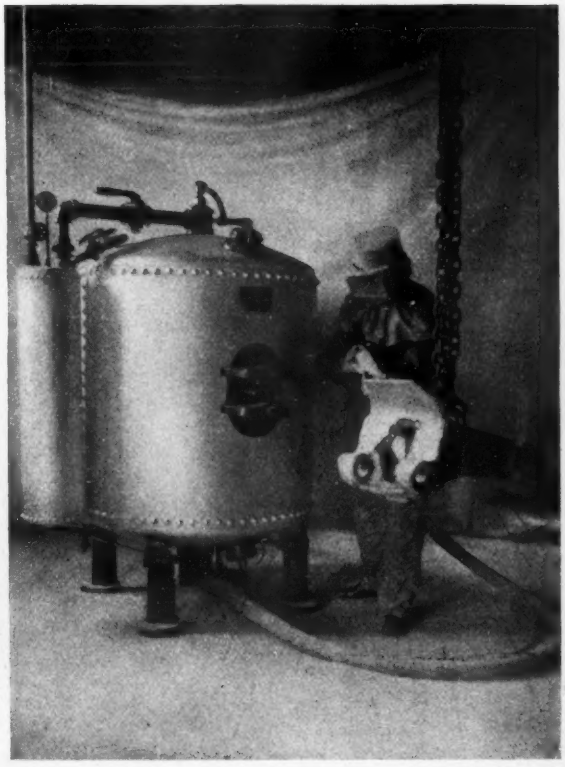


FIG. 12. SAND BLAST APPARATUS.

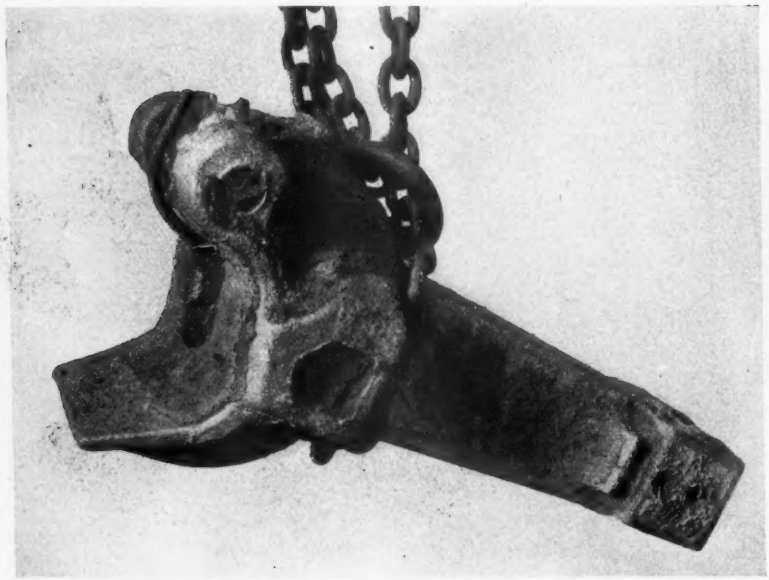


FIG. 13. BEFORE SAND BLASTING.

It has been an operation requiring time and patience, and involving heavy expense. The cleaning of castings is a subject that has been given unusual attention, being followed by experiments with various and sundry methods and devices for the successful and ecomonical accomplishment of the desired results, including brushing, tumbling, pickling, blowing, etc. These methods have each shown marked advantages as applied to particular classes of work, but as a commercial proposition for all classes of castings, large, medium and small, steel, iron, aluminum and brass, the solution has been found in the sand blast, and here again, compressed air plays a most important part and shows its superiority over other

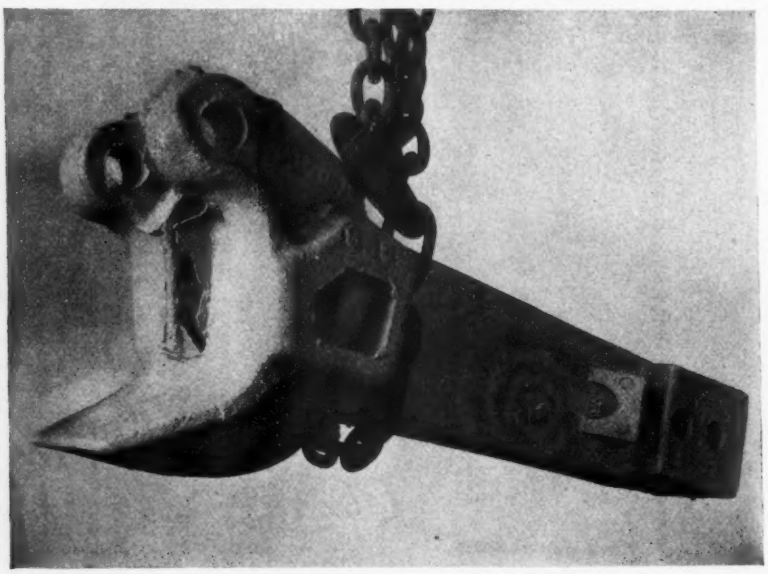
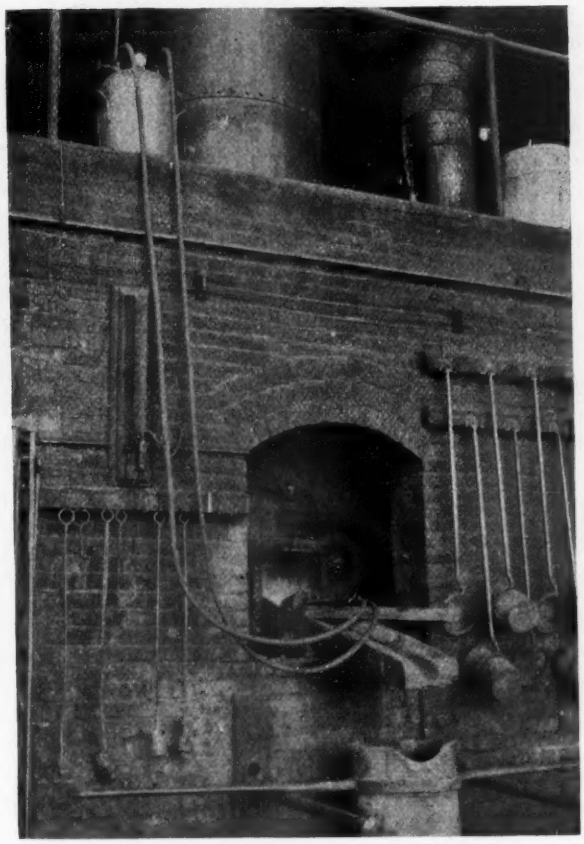


FIG. 14. AFTER SAND BLASTING.



AIR TORCH LIGHTING CUPOLA.

actuating powers for general foundry work.

The sand blast, however, is by no means a late development, but it is only within recent years that it has been perfected to a stage where it produces satisfactory results, as applied to both external and internal surfaces, and also crevices, and combines economy in power, that is, in the consumption of compressed air, with effective savings in both time and labor, and a resultant total economy.

There are many makes, styles and kinds of sand blast apparatus on the market, and superior points are claimed by the manufacturers for each, some advocating the use of air under high pressure, and others under low pressure. The proper air pressure for sand blasting as applied to particular classes of work, has been the subject of much discussion among foundrymen and also sand blast manufacturers, and numerous theories have been expressed through the trade journals. There have also been a number of tests conducted on different classes of work, with varying air pressures, and the consensus of opinion as expressed in the reports of these various tests, at least so many of them as it has been the writer's privilege to read, seems to favor the high pressure blast for all classes of work. It is conceded that the volume of air required is governed by the size of the opening in the sand blast nozzle, and the pressure maintained, based on the standard flow of air at a given pressure through a given size orifice. Therefore, the higher the pressure, the greater the volume of air used, but the amount and quality of work done increases correspondingly without added labor costs. It has been proven in these tests that twice as much work can be done at 50 lb. pressure as at 20 lb., at 64 lb. as at 30 lb., and at 72 lb. as at 40 lb. It has also been shown that for gray iron and malleable castings they can be cleaned best and quickest with an air

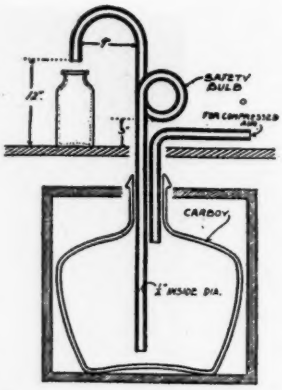
pressure of 80 lb.—brass and aluminum castings at not lower than 60 lb., while for steel castings, the hardest to clean, not less than 90 lb. The character of the material and its ability to withstand the impact of the sand will determine the pressure adaptable.

As a result of a very thorough test of the economy of sand blast cleaning, conducted by one of our leading technical schools, in collaboration with one of our largest steel foundries, I am able to give in tabulated form data showing that the total cost per ton for cleaning castings, with a modern high pressure sand blast, is less than $0.80. This is figured on a basis of an equipment valued at $4,000 and including interest at 6 per cent., and depreciation 10 per cent.; also power for exhaust system.

Air pressure generated	97.5
Air pressure at blast, lb.	80
H. P. for air	53
Interest and depreciation	$.0307
Maintenance, air	$.105
Maintenance, sand	$.279
Power for exhaust fan	.0577
Nozzle	.0104
Total	.4828
Labor	.316
Total	.7988

CLEANING BRASS CASTINGS.

An interesting modern sand blast installation designed by the Thomas W. Pangborn Company, Hagerstown, Md., includes sand blasting machine, sand separating machine, sand elevator, exhauster and dust arrester. The sand blast is used extensively in connection with tumbling barrels. In one case a load of 360 lb. of small brass castings were put into the barrel just as they came from the mold and the entire time consumed for the cleaning was 15 minutes, which included the loading and unloading of the barrel. The average pressure maintained on this run was 70 lb., and the abrasive used was No. 40 Angular Grit, through a ¼ in. nozzle. In a paper by Professor William T. Magrader before the American Society of Mechanical Engineers, he said that the precise locating of the blast nozzles as to distance and angle of delivery had much to do with the celerity and efficiency of the sand blast operation.



SIPHONING FROM CARBOYS

The sketch here reproduced from the *Chemist-Analyst* shows a convenient device for siphoning acid, ammonia, etc., from carboys. The tubes shown are made of ½ in. glass and the air pressure should be controlled by a slow opening valve—preferably three-way—after expelling the contents of the carboy, or any portion of them, when only the pressure of the atmosphere is left the contents of the tube will flow back into the carboy and there will be no dripping.

NATURAL GAS THE IDEAL FUEL

Natural gas is the best fuel known to man. No advance beyond it is possible, but to secure the best results some scientific knowledge is required in regulating its combustion. Since it is the perfect fuel, it admits of application to almost every purpose to which fuel can be turned. The principal exception is in the manufacture of iron from its ores, and in other similar metallurgical processes. In the working of iron ore rolling mills, forges and foundries, and in the production of steam for all its multiforious applications, in the direct use of heat in the manufacture of glass and cement, in the burning of pottery, tile and brick, it is, as before said, the perfect fuel. It effects important economies and greatly improves the quality of production at the same time. But superlatives in describing its advantages and value ought to be reserved for its use as a household fuel. It is here that it does the greatest good to the greatest number. It lightens and simplifies the labors of housekeeping to a surprising extent.—*Dr. Edward Orton.*

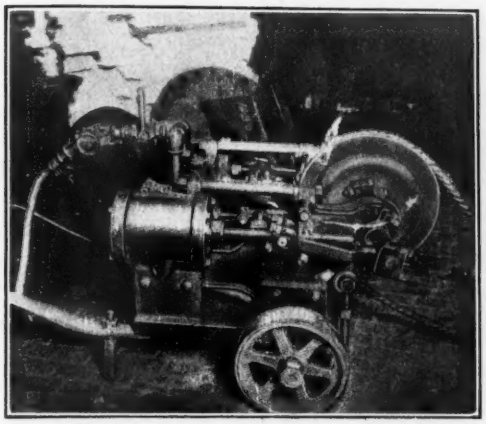


FIG. 2.

COMPRESSED AIR TOOLS IN RAILROAD SHOPS

In every up-to-date machine shop employing say a dozen men or more, and especially in every railroad shop, a constant compressed air service is now to be regarded as a necessity, and wherever the air is thus ready at hand new devices are constantly being devised for its employment. In the big railroad shops these devices are too numerous and too familiar to be noticed at all unless they possess some features of novelty.

The two half tones on this page, reproduced from the *American Machinist,* show two home-made devices in construction in the big shops of the Northern Pacific at South Tacoma, Washington. Neither of these devices require much explanation.

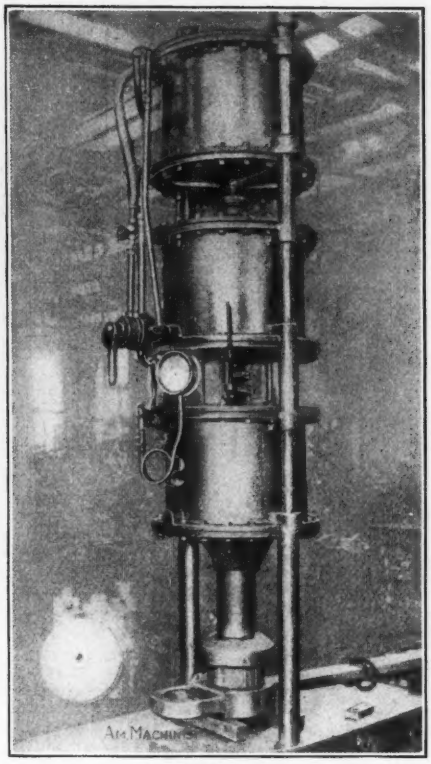


FIG. 1.

The tandem press, Fig. 1, merely applies three times the force of a single cylinder while

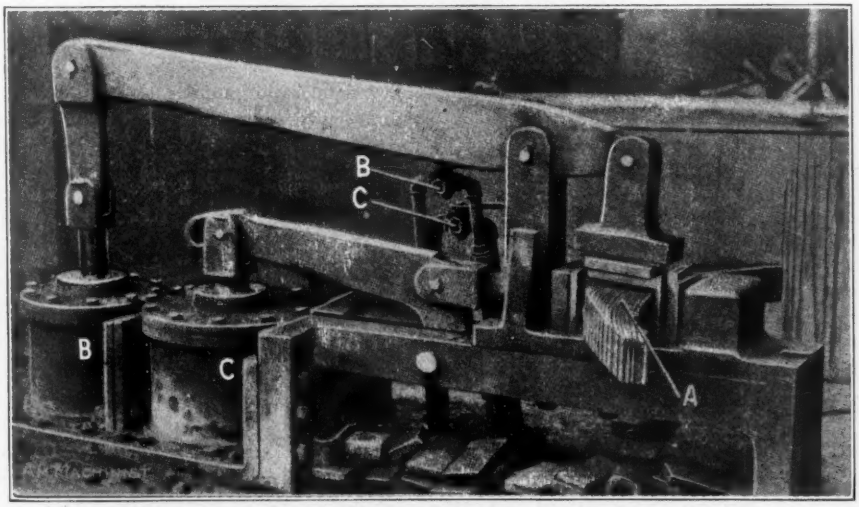


FIG. 3.

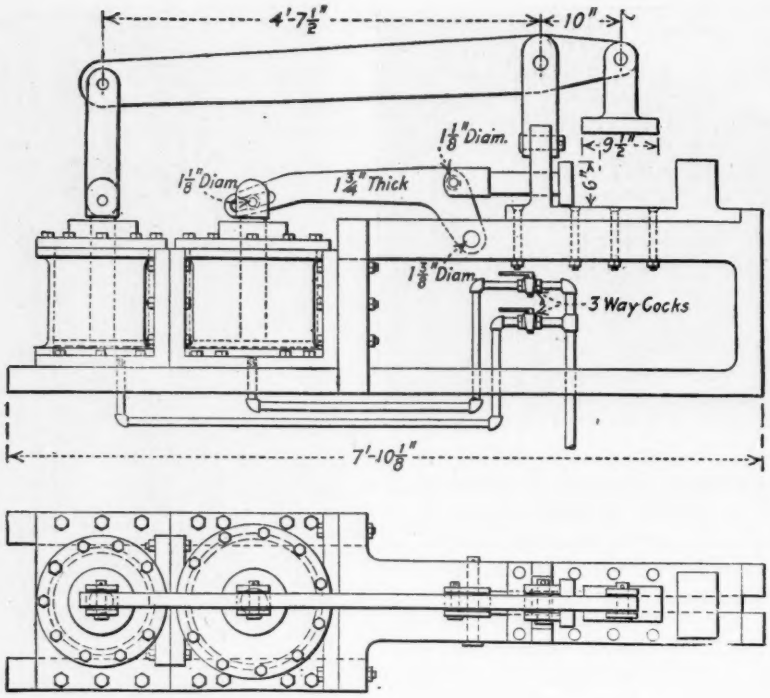


FIG. 4.

occupying no more lateral space. For lifting the pistons the air is applied only to the lower one, the lower ends of the other cylinders being in free communication with the atmosphere. In applying pressure to the work as required, the lower cylinder alone may be used, and if that is not sufficient then either or both of the others may also be thrown into service. There is thus no greater volume of air used than is actually required for the work.

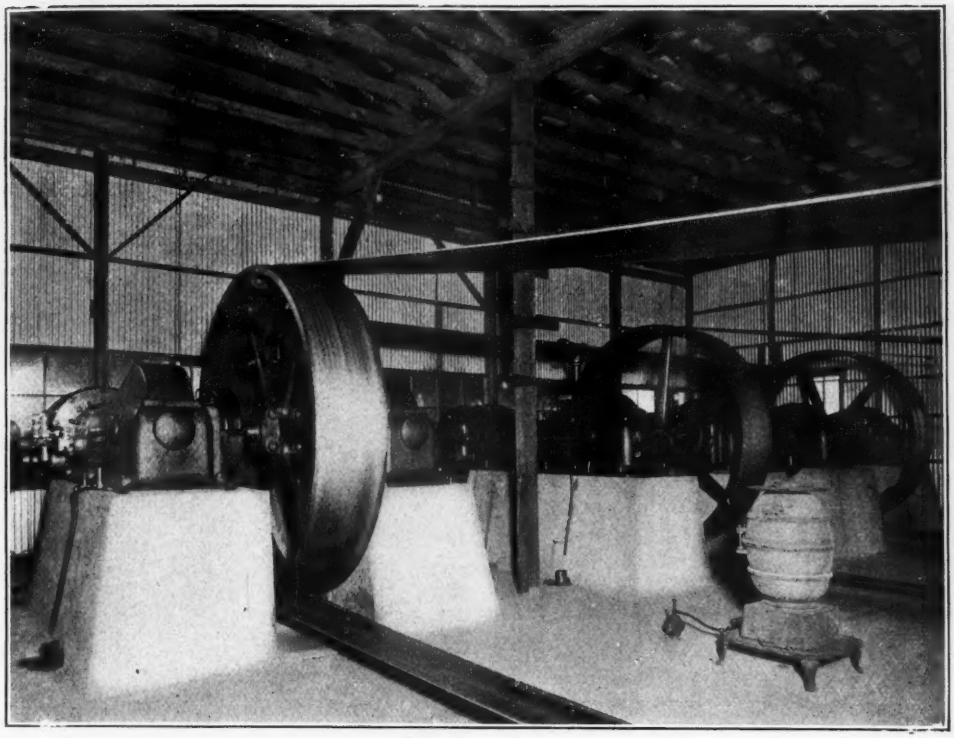
Fig. 2 is simply a two cylinder engine mounted upon a hand-drawn truck to be run around the shop for driving temporary boring bars, valve facing machines, drills, etc. The power is transmitted by a round belt or rope from the grooved wheel on the crank shaft, this drive requiring no careful alignment.

Figs. 3 and 4 show a machine, made in the shops of the Central of Georgia Ry., Macon, Ga., used for compressing the hot bands around springs for car trucks. The spring leaves are assembled by pressing them together and slipping a retaining ring in place. Then the hot band is driven on, the spring is placed as shown at A, and the air is turned into cylinders B and C, forcing up the pistons and compressing the spring band all around, making it hug the spring leaves so that as it cools and shrinks they are held snugly together.

SCULPTOGRAPHY

This is a process which has been perfected by a Boston inventor for making plaster or metal casts of the human body or any portions of it that may be desired. Compressed air, by an operation similar to that of the cement gun, sprays over the part to be reproduced a coating of warm liquid which quickly solidifies forming a hard shell or mold which is then removed and plaster casts may be made in the usual way. It is claimed that the liquid used will not stick to the hair, eyebrows or mustache, and the texture of the skin is perfectly reproduced.

Dr. Bertelsmann has written a treatise on the influence of gas and its use on the smoke problem, and has proved that the use of gas engines in the industries would lead to a solution of the smoke abatement questions never to be reached by direct burning of coal.



ORONOGO CIRCLE COMPRESSOR PLANT.

ELECTRIC DRIVE IN ZINC MINING

BY S. A. ALLISON.

Since the introduction of electrical power in the Joplin lead and zinc mining district in Southwest Missouri three years ago, practically every producing plant of any capacity has re-installed with motors, and is now using the cheaper and more efficient power supplied by a service which has never yet failed.

One of the latest plants in the district to re-equip with new machinery, driven throughout by electricity, is the famous Oronogo Circle Mill at Oronogo. The Oronogo Circle is one of the oldest producers in the district and has been listed regularly in the "turn-in" columns for nearly twenty years.

On December 1, 1912, the Oronogo Circle completed its re-equipment of a modern, up-to-date in every respect, 1,000 ton capacity mill. The plant is under the able management of A. J. Burnham, a practical mining man of years experience in the district, and who has a record of driving a mine to its greatest efficiency and production at all times.

When it was decided to re-equip the famous old producer, careful consideration was given to the selection of the best machinery and equipment possible, for the plant is blocked out as a producer for the next twenty years.

With an Ingersoll-Rand Class F. 1 Calyx Diamondless Core drill the property has been prospected, with ore finds which will run for at least the period mentioned. The ground has been tested to a depth of 350 feet. Ore bodies running in high grade have been found on the 135, 180 and 260-foot levels, and all of these levels are being worked.

The ground is being broken with 18 3¼ inch Ingersoll-Rand rock drills and with eight C 110 (one man) drills. The ground work is done in *one* eight-hour shift and sufficient dirt is broken to keep the mill running *three* steady eight-hour shifts. The average hoisting of the mine is 26,000 tons of crush rock in a month.

The rock drills in the ground are run by three 800-foot two stage Ingersoll-Rand Imperial Compressors, the very latest model. Each of these compressors is driven by a 100-horse-power motor.

There are two 4 inch two stage centrifugal pumps and one 4 stage 10 inch centrifugal

pump, with two cross-head Cornish lift pumps installed to meet any emergency in wet ground.

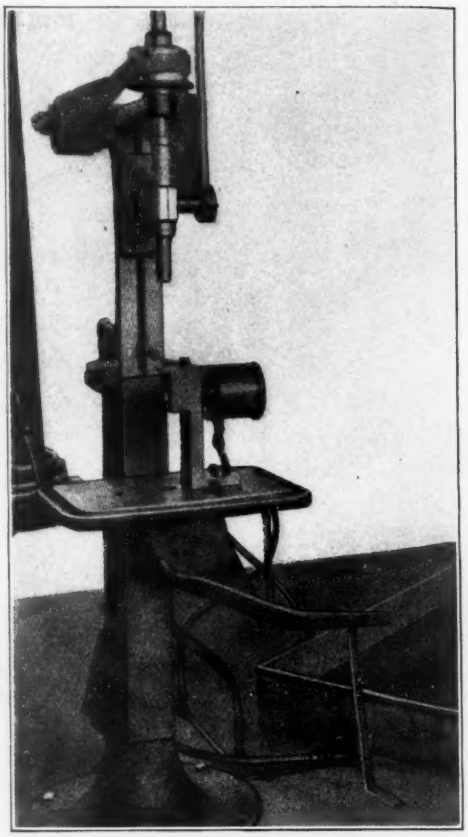
There are few, if any, plants in the entire district better equipped than is the Oronogo Circle. The new plant has been working long enough so that the efficiency of its machinery working as a unit has been carefully tested. Mining men in all parts of the district have pronounced it one of the best, if not the best, in the entire camp.

Practically all of the new plants in the district, however, are now being installed similar to the Oronogo Circle. Electrical power is found to be the best and the cheapest, and the power that practically never goes down. The types of machine used to break the ground have been found to be the best by far that can be used in the sheet-ground district in the heart of which the Oronogo Circle lies.

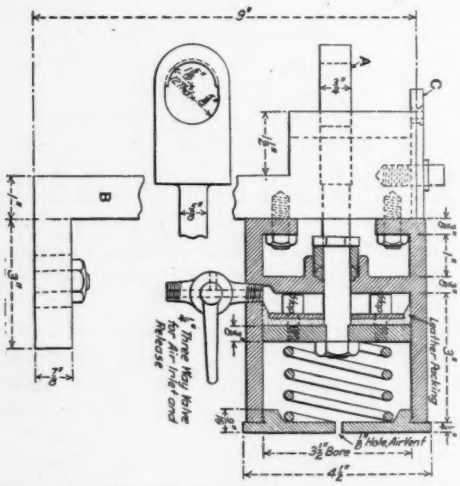
The olden days when it required *three* shifts in the ground to break enough dirt to run the mill *one* shift is passed when the largest type mill yet built here can be kept running three full shifts with ground broken and hoisted in one shift.

PNEUMATIC CHUCK FOR STAYBOLT DRILLING

A constant job in railroad shops is the drilling of tell-tale holes in staybolts, this being a government requirement. The hole is drilled axially into the outer end of the staybolt to such a depth as to project into the steam or water space when the staybolt is in service. If the staybolt cracks or breaks the steam or water blows out through the drilled hole and gives immediate warning.



STAYBOLT CHUCK ON DRILL.

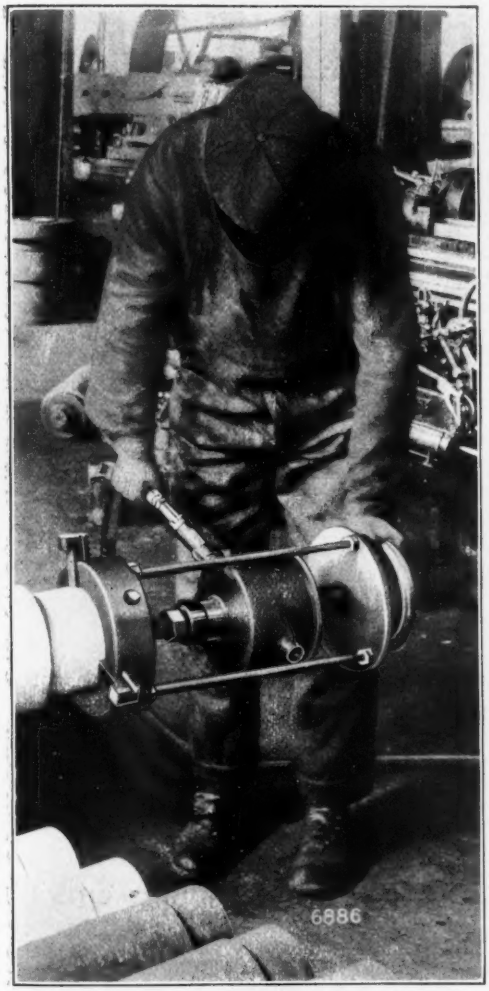


PNEUMATIC STAYBOLT CHUCK.

The illustrations, from the *American Engineer,* show a device for holding the staybolts for drilling as described by J. C. Breckenfeld, of the St. Louis and San Francisco shops, Springfield, Mo. With the arrangements previously used six or eight drills were broken per day in drilling from 175 to 300 staybolts. With the device here shown in use the output was increased to about 800 per nine-hour day, and the breakage of drills was reduced to one or two and sometimes none per day.

The holes to be drilled are 7-32 in. diameter and 1½ in. deep. The bolt is slipped up through the large opening in the slide A until it touches the under side of the projecting plate C. The air is then admitted to A the cylinder, this operation pulling slide and clamping the staybolt in the V notches and locating the end of the bolt exactly central under the bushing or drill guide in plate C.

The drill, which runs constantly, is fed down by a hand operated lever until a stop is reached, which gages the depth of the hole. The lever is then released and a counterbalance raises the drill out of the hole while the operator with his right hand operates the three way air valve, which allows the bolt to drop into a chute below, while with the left hand another bolt is inserted, and so on, until the operator stops for a rest.

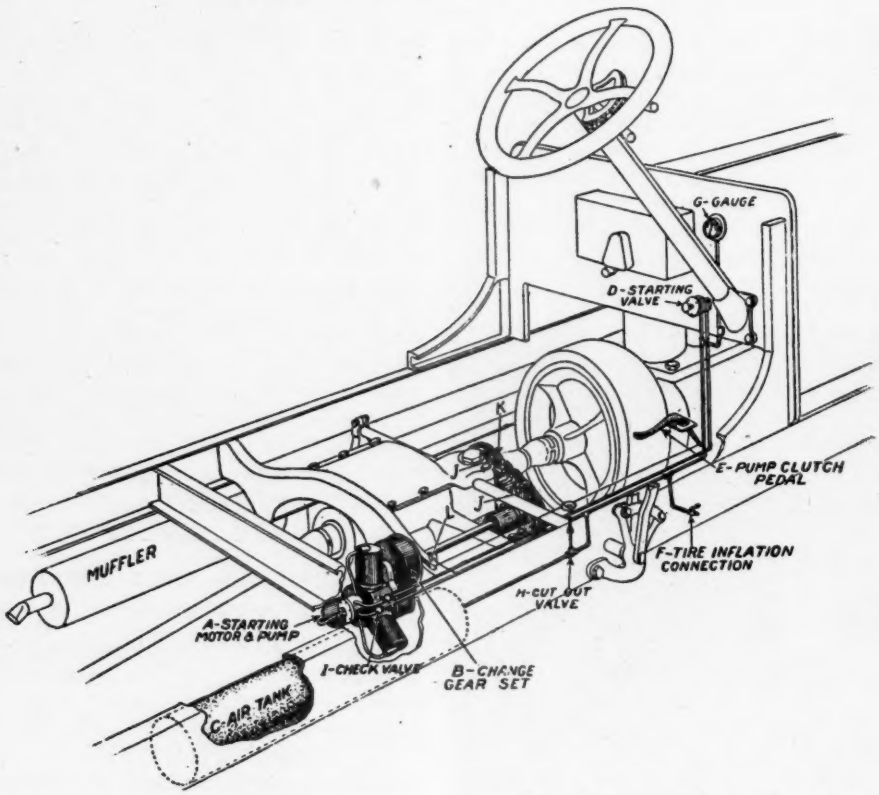


A HANDY PNEUMATIC CENTERING DEVICE

The half tone shows a portable pneumatic centering device in use in the Painted Post shops of the Ingersoll-Rand Company. As here shown it is being used for recentering a lot of compressor shafts which have been roughed out and cut off to approximate lengths and are now ready for the final turning and grinding. The universal lathe chuck is connected, by three rods which serve as guides for the drill, with a casting at the back through which the feed screw passes. The drill chuck fits a central bushing in the large chuck, this ensuring the accurate centering of the piece. The chuck is quickly secured on the end of the work by the usual socket chuck-wrench. Then the operator controls the air supply with his right hand and turns the feed wheel with the left hand. When the drilling begins he can note the turns he gives the feed screw and so get the centers very nearly the same size. The Imperial Piston Drill is used, giving a positive motion with ample power.

COMPRESSED AIR DISLODGES ANCHOR ICE

An apparatus for utilizing compressed air to dislodge the anchor ice which forms in the ports of the water-works intake cribs during the winter was installed at the Two Mile crib of the Chicago, Ill., water-works during the fall of 1911. It is arranged as follows: A new 10x8x10-in. Westinghouse air compressor was installed and arranged to discharge into a receiving tank of about 50 cu. ft. capacity. The operation of the compressor is arranged to give a maximum of about 80 lb. pressure in the receiving tank. When any of the ports show signs of being blocked by anchor ice a standpipe running down into the center of the port is connected with the air-receiving tank by means of a 2½-in. hose. After the hose and standpipe are in place the full load of air under 80 lb. pressure is discharged through the hose and into the port by operating a quick-opening valve at the air tank. By giving the full head of air through the port and from expansion of the air in the water the force to dislodge the ice which has formed on the walls of the port is secured. In former years the anchor ice was dislodged by using water under pressure in practically the same manner as described above. It was found, however, that the water would not give the same result as a like quantity of air under the same pressure, and after making tests of the use of water as compared with air the change was made to the air apparatus.

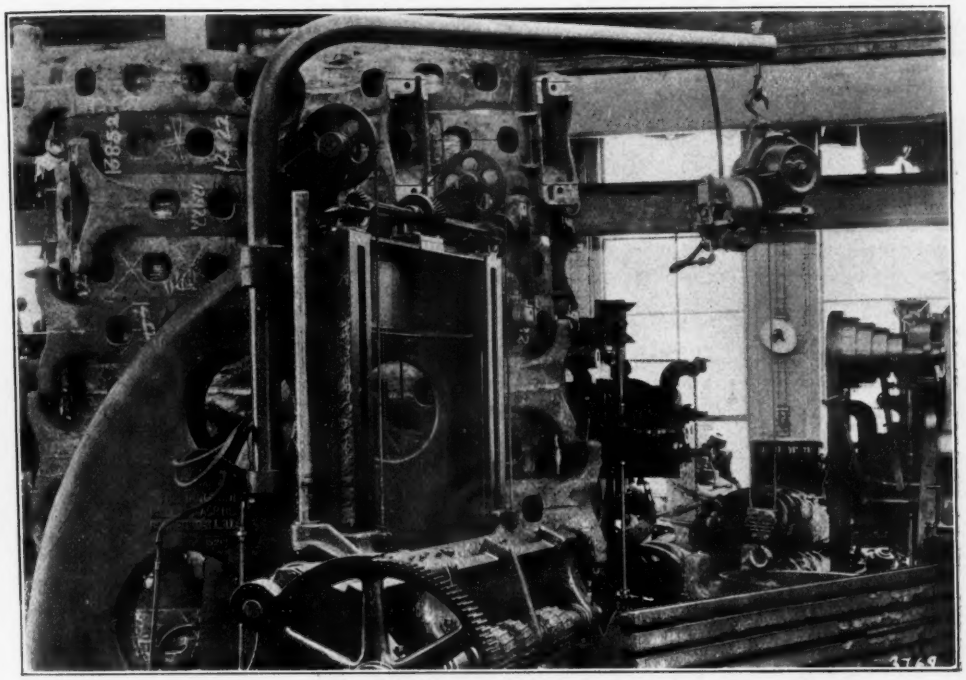


COMBINED AIR PUMP AND AUTO STARTER

A motor starting system which can be installed on any gasoline car, truck or motor boat has been designed by the Motor Starting Co., of Akron, O. At *A* is shown a combined three-cylinder pump and starting motor which supplies pure air under pressure to the tank and operates as a compressed air motor to start the gasoline engine by rotating it until it takes up the regular cycle under its own power. The change gear set is attached to the starting motor at *B*. The gear set is always in position to start the engine without any gear shifting, and it is only necessary to press the starting valve *D* on the dash. The pump clutch pedal *E* puts the pump into action for compressing air while the engine is running, regardless of speed. At *C* is shown an air storage tank 7 inches in diameter and 36 inches in length. Sufficient air may be kept in this tank to start the motor and to inflate tires at all times. The automatic starting valve *D* admits air to the engine merely by pressing the button, and closes when the button is released. A connection for the air hose for inflating tires is shown at *F* at the side of the car, and a dash gauge *G* is supplied to indicate the amount of air in the tank. There is a safety cut-off valve *H* which prevents leakage from the tank to the motor when the car is to be stored for some time. There is also a check valve *I* in the air line. The motor turns the engine by means of a sprocket and silent chain drive to the transmission shaft at *K*. An adjustable support is used for mounting the air pump and gears, this support being made to fit any car. The total weight of the apparatus installed is between 50 and 60 pounds.—*Horseless Age.*

PNEUMATIC HOISTS IN MACHINE SHOPS

The most numerously and extensively used compressed air-operated device in machine shops, and probably the most valuable, is the pneumatic hoist. The straight-cylinder, direct-lift hoist, being the simplest and the first thought of, was in the beginning practically the only device employed, and it is found in use wherever there is a permanent supply of compressed air; but it has seriously objection-

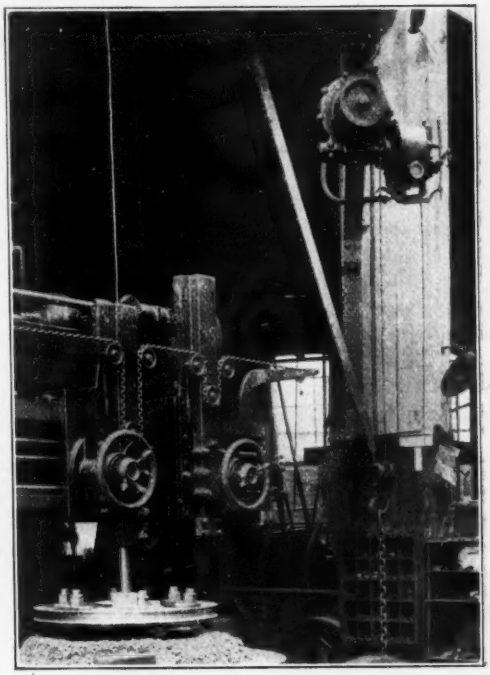


IMPERIAL MOTOR HOIST FOR A MILLING MACHINE.

able features. It is not as cheap as might at first be thought, especially when the conditions of installation which it imposes are reckoned with.

The overhead room required for the vertical cylinder hoist and the length necessary for the hoist with the horizontal cylinder are always bad and often prohibitory. The movement of these hoists is not positive, and unless the air valve is very sensitive and manipulated with care both hoisting and lowering are uncertain and jerky and the inevitable leakage makes any long suspension of the load practically impossible.

The pneumatic motor hoist, which developed later, must be recognized as a decided improvement. It requires a minimum of head room independent of the height of lift, which may be as great as any class of work can call for. In commencing a lift the slack is taken up by the use of very little air, and in the actual hoist the air consumption is exactly according to the load. Both hoisting and lowering are absolutely and delicately controlled. The hoist, for instance, can be started and stopped a dozen times within an inch of vertical travel. The load is positively held for



IMPERIAL MOTOR HOIST FOR BORING MILL.

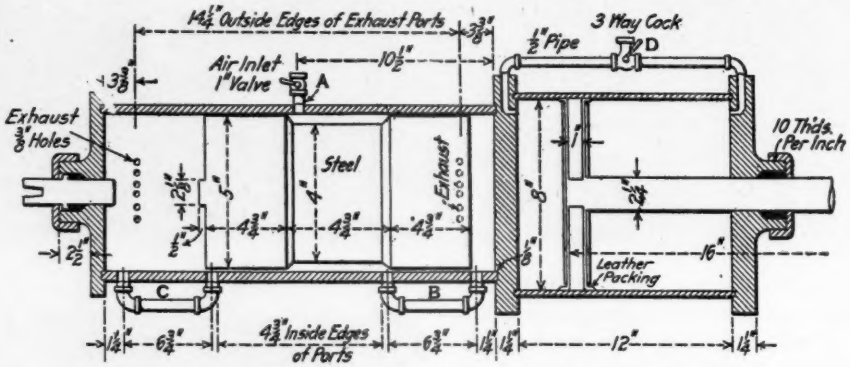
unlimited time and cannot be accidentally dropped under any circumstances. The hoist may be suspended in a fixed position, can be mounted on a jib crane or on an overhead trolly.

Fig. 1 shows the Imperial Hoist serving a horizontal milling machine in the plant of the Bullock Electric Company, East Norwood, Ohio, and Fig. 2 shows a hoist of the same type which loads and unloads a vertical boring mill in one of the plants of the Otis Elevator Company.

The Imperial Motor Hoist is made in five sizes, with capacities, respectively of ½, 1½, 3½ and 5 tons, with a lift of 20 feet for either.

A HANDY PNEUMATIC HAMMER FOR BOILER SHOPS

The drawing and description of this hammer was sent to the *American Machinist* by I. C. Brekenfield, St. Louis and San Francisco R. R. shops. Springfield, Mo. It has been in use several years and has proved efficient as a staybolt breaker and a riveter, as well as for general use. The working cylinder, 5 in. diameter, contains a floating piston. Each end of the cylinder communicates with the atmosphere by means of the six ⅜-in. exhaust holes drilled 3⅜ in. from each end. These holes are covered when the piston approaches the ends of the cylinder and the enclosed air forms a



POWERFUL PNEUMATIC HAMMER.

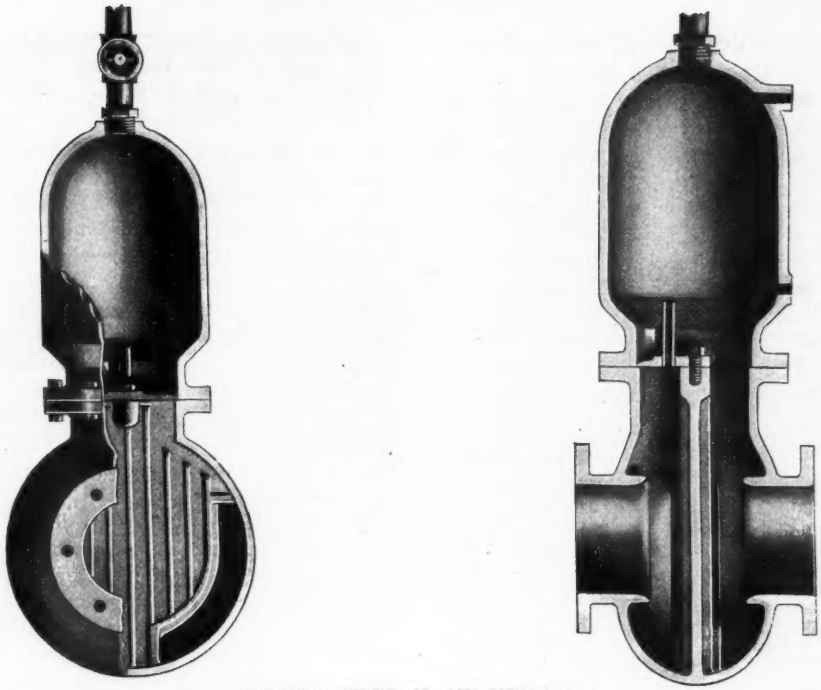
A NEW HEIGHT RECORD

A new height record of 6,000 meters (3¾ miles) was made recently by M. Perreyon, chief pilot of the Blériot school, with a Blériot monoplane fitted with a 160 horse-power Gnome motor. Perreyon rounded the field in great circles, steadily rising until he had reached a height of 5,700 meters (18,700 feet), after which he flew in a nearly straight line in his endeavor to reach a still greater height. After an ascent lasting about an hour, he finally reached 6,000 meters (19,685 feet). The air was so clear that he could see as far as Rouen, a distance of 75 miles, and he was also visible from the ground throughout the whole of his flight. The 100 liters of oxygen which he carried gave out, and so he was obliged to descend at once. He reached the ground in 12 minutes from this tremendous height. He was not troubled with dizziness, as he inhaled oxygen—a thing which none of the other aviators have done who have flown to such a great height.

cushion. The compressed air enters the cylinder at A, fills the annular space at the center of the piston and passes back of the piston through pipe B, driving it forward. A projection is provided on the piston for striking the hammer, and the latter can be changed at will. When the piston is in the forward position the air passes through pipe C, the connection B being covered. At the rear of the tool is an 8 in. cylinder with piston and rod which are used to brace the hammer and hold it against the work. For certain conditions of work this piston may be made to pull instead of thrusting.

NEW IRON MINE SHAFT SINKING RECORD

Working twenty-six days during the month, with no Sunday work, crews of shaft sinkers employed on eight-hour shifts performed the remarkable feat of sinking New C shaft at the East Norrie mine of the Oliver Iron Mining Co. 105 feet in March. Not alone was the



SECTIONAL VIEWS OF AIR SEPARATOR.

shaft sunk more than one hunred feet in the twenty-six days, but the heavy steel sets were placed in position, the concrete slab-lathing was put in place for the entire distance, also the back-runners. The magnitude of the work may be better understood when it is realized that 24,600 cubic feet of rock was broken and hoisted to surface, and the labor of placing the shaft equipment, consisting of two skip-roads, one cage-road, ladderway, pipe compartment, counter balance and back-runners, completing a modern five-compartment shaft, was all performed in twenty-six days.

Each piece of concrete slab-lathing weighs 130 pounds, and the steel sets are made of very heavy material. Six Jackhammer drills were used in sinking, and the efficiency of the machines and skill of the crews engaged in the work may be judged from the wonderful results obtained. Capt. Gus Erickson and his men are to be congratulated. They have done a fine piece of work in record time, bringing nearer the day when old C shaft will be dismantled and the scene of mining activity shifted from the encroaching residential district of that section of the city to the much better location one thousand feet farther south. —*Ironwood (Mich.) News Record.*

A SEPARATOR FOR COMPRESSED AIR SERVICE

The readers of Compressed Air Magazine may be assumed to be generally familiar with the fact that all air with which we have to do normally contains considerable quantities of aqueous vapor, and that when the air is compressed there is more of this vapor than the air can carry and more or less of it is condensed into actual water, but still minutely commingled with the air.

When air is at its highest pressure and its lowest temperature its capacity for aqueous vapor is at the minimum and its quantity of entrained water will be the greatest possible from the original content, and if while the air is in this condition the condensed and liberated water can be separated and abstracted from the air it cannot be heard from as a trouble-maker later. It has been learned very slowly in practical compressed air working that this water distributed in minute particles through the air will only settle down through the air and separate itself very slowly. It will not settle in the bottom of the receiver, as it has been assumed to do, but will be carried along through the piping to the drills or pneumatic tools or other apparatus where the air is used.

It happens, however, that the water may be easily separated from the air if the necessary provision be made for it. A separator which has proved itself effective with steam is equally effective with air in removing both water and oil.

The two cuts on preceding page are vertical sections at right angles to each other (and unfortunately not both exactly to the same scale) of the well known Cochrane separator, so effective in separating oil and water from steam that it now claims to have 10,000,000 H. P. of steam boilers under its protection.

The separator as here shown is designed for bolting into a horizontal pipe. The liquid particles, water or oil strike against a central vertical ribbed baffle-plate adhering to the surface and dripping down into the receiver below, from which the accumulations can be drawn off as they accumulate. The receiver and also the baffle plate can be removed for cleaning without disturbing the pipe connection. Built by the Harrison Safety Boiler Works, 17th St. and Allegheny Ave., Philadelphia, Pa.

A MUCK THROWING KINK

The readers of COMPRESSED AIR MAGAZINE should by this time be quite well informed of the fact that the progress of a tunnel heading depends largely upon the rapidity with which the "muck" is cleared away after a blast, and they will therefore be able to appreciate the following operation as described by Mr. J. H. Graham in a recent issue of the *Engineering Record*.

After the "cut shots" and "side shots" had been fired, and before shooting the "roof shot," a "muck shot" was prepared. This consisted of eight sticks of 60 per cent. giant gelatine, placed against the face immediately under the "roof shot," and covered with sand. In one of these eight sticks was placed a "delayed electric exploder," which was connected with the roof holes, and exploded a second after the "roof shot" went off. The rock from the roof holes would drop vertically upon the "muck shot," which would then go off and hurl the muck away from the face. In this way the immediate face of the heading was cleared of muck, and one hour was saved in making room to set up the columns for the next round of holes.

OZONIZING THE AIR IN PUBLIC BUILDINGS

The Westinghouse Electric and Manufacturing Company is placing on the market an apparatus for purifying the air of public buildings, clubs, residences, etc., by means of ozone. The ozonizer consists of a step-up transformer, tubes for generating the ozone and a regulating switch, all contained in a portable case. The function of the transformer is to raise the voltage of the supply circuit to that required by the ozone-generating tubes. These tubes are of glass of special construction, having an outer coating of metal made to adhere closely to the glass by a special process. The inner walls of the tubes are lined with a metal mesh which forms the ozone-generating surface.

The generating cylinders are located above the transformer and stand vertically, so that the warm air rising from the transformer and from the inside of the generating tubes causes an upward draft, drawing in fresh air at the bottom and giving off a uniform flow of ozonized air at the top. On top of the case is a knurled knob connected to the regulating switch located inside the case, which is connected to the generating tubes in such a manner that, by turning the knob to the positions indicated on the dial, the number of tubes in operation may be regulated from one to four, with a corresponding change in the unit of ozone.

COTTON SAMPLES STORED IN VACUUM TUBES

The third annual opening of cotton samples, first stored in vacuum by the department of agriculture in 1910, took place recently. Careful, practical and technical examination fails to disclose the slightest appreciable change in the cotton. This result confirms the previous tests, and renders it very certain that storage of standard types of cotton in vacuum tubes is a practical solution of the question of the permanency of such standards. The United States official grades are stored at the department of agriculture at Washington in vacuum tubes to be opened from year to year and used as models for the sets of grades sold by the department in accordance with law.

Peary went through two years in the Arctic without a "snuffle" and nearly died of grippe caught in a closed cab.

COMPRESSED AIR MAGAZINE

EVERYTHING PNEUMATIC

Established 1896

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PUBLISHED MONTHLY BY THE

Compressed Air Magazine Company
Easton, Pa.

New York Office—Bowling Green Building.
London Office—165 Queen Victoria Street.

Subscription, including postage, United States and Mexico, $1.00 a year. Canada and abroad, $1.50 a year. Single copies, 10 cents.
Those who fail to receive papers promptly will please notify us at once.
Advertising rates furnished on application.

We invite correspondence from engineers, contractors, inventors and others interested in compressed air.

Entered as second-class matter at the Easton, Pa., Post Office.

Vol. XVIII. JUNE, 1913. No. 6

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THE PNEUMATIC PACEMAKERS

It may be noted by the readers of our present issue that its contents have largely to do with the variety of air operated devices which are in use in the shops, and which in so many instances supersede or supplement the physical strength or the dexterity of the workman in the mechanical trades.

It will generally be considered that the most extensive and important of all compressed air employments is in the driving of the rock drill and its now numerous progeny, as employed in the wide range of work covered by the several lines of quarrying, mining, tunneling, foundation sinking, and in rock breaking and excavation work for whatever purpose.

This estimate we will not question; but still the use of pneumatic tools, distinctively so called, in all the metal trades, of molding machines in the foundry, of the tools which now do all the work, of the boiler shop, of presses and hoists in all the shops, and especially of the endless variety of special pneumatic devices, mostly homemade, which are now to be found in all the railroad shops and in many others, these collectively form an imposing array and cover a vast field of activity and usefulness.

It is natural as we note these developments to at once consider and try to measure the economics effected, the saving of time and labor as compared with the cost of installation, operation and maintenance of the new devices. But we do not go very far in that before we find that it is too late a day to be figuring about the cost of pneumatic tools in the shops, to be able to state in dollars and cents the actual saving accomplished in a given time. We might as well try to figure the cost of the telephone in the modern office to compare it with the cost of correspondence and messenger service which it supersedes.

And even if it were theoretically possible to make actual computations on both sides so as to deduce a balance, it would be impossible in practice, because so many more kinds of things are done than would have been done under the old arrangements and because the speed of working has been quickened all around.

On another page we present a sketch and a slight description of a staybolt driller gotten up in a railroad shop with an account of the

great increase effected in the output. The pneumatic device was most important of all not in itself, but in that it furnished the opportunity and the stimulus for a systemizing and a rearranging of the entire cycle of operations. It would seem that in this case motion study could be carried no farther. To drill holes 1½ in. deep in the ends of 800 staybolts in 9 hours, would allow only .675 min. for each, without a single minute of respite, which latter detail would be impossible, and the actual time per actual unit could scarcely have averaged above .5 min.

Supposing a staybolt in place and the drilling going on, the operator continues to press down the drill feed lever with his right hand, and when the stop is reached and the hole is drilled to the required depth he lets go of the lever and the machine automatically pulls the drill up out of the hole. Then the right hand operates the air valve, the staybolt is released and drops, and the left hand, which has in the meantime picked up another staybolt, inserts it in its place, which is all that the left hand has to do. The right hand has only to turn the air valve again and then begin to press down on the feed lever, which completes the cycle of operations. Of the 30 seconds allowed as above, probably 25 of them can be occupied in the actual drilling, and all the operations involved in the changing of the staybolts can be comfortably accomplished in the other 5 seconds. When it has once been made apparent that this pace can be comfortably maintained, any return to the old gait can not be thought of.

CARE AND LUBRICATION OF AIR COMPRESSOR

The following is from Safety Pamphlet No. 2, Alabama Operators Association, prepared by Jas. L. Davidson, secretary, under the approval and direction of the Mine Casualty & Mining Institute Committee.

Having noticed in the Alabama Supreme Court Reporter a decision, awarding heavy damages to the administrators of a man killed in the mines by gas from the exhaust of a compressed air driven pump, when he went to start up the pump; the secretary takes the liberty of giving you the following information, gathered from reliable sources, in regard to the care and operation of air compressors, with respect to safety and efficiency, viz:

It is a fact that air compressors frequently pollute the mine air with dangerous gases, and sometimes explode, causing damage to persons and property. In either case the same may be generally attributed to the excessive heating in the presence of compressed air of the oil and foreign substances that have collected in the cylinder, discharge pipes and air passages and especially in and around the valves. Volatilization and ignition of oil and other carbonaceous matter occurs very rapidly in the presence of highly heated air.

The greatest heating takes place where the air passes from the cylinder into the discharge pipe.

Even though the compressor is equipped with modern and approved cooling devices, insufficiency of size or too many angles in the discharge pipe, or incrustation of dust mixed with oil, at the discharge opening, decreasing the capacity of the discharge any or all of them may produce enough heat to cause an explosion, or anyway, produce dangerous gases, which should not enter the mine.

It is therefore, important:

First. To keep the compressed air, while being compressed, at as low a temperature as possible.

Second. To prevent oil and other carbonaceous substances from collecting in any part of the machine or in the discharge pipes.

All ports and air passages should be as large as practicable and should be kept free from obstructions and incrustations. In addition to partly closing the ports, incrustation often causes the valves to stick resulting in disastrous consequences.

To avoid incrustation and collecting of oil and foreign substances in the machine and discharge pipes, high grade non-carbonizing oil may be used and should be properly fed into the cylinder. Petroleum oil, especially free from volatile carbon, with flash point of not less than 625 degrees F. is recommended. The oil should not be too dense nor contain animal or vegetable oil. Do not, in any case, use ordinary steam cylinder oil. Why? Because the heat in the steam cylinder is moist, and the surplus oil is washed out, whereas, the heat in the compressor cylinder is dry, thus causing the oil to stick and cake. For the above reason, and also on account of the difference in the character of the proper lubricant and the work it has to perform, the proper feeding of

oil to the compressor cylinder, is very different from the oil fed to a steam cylinder. Too much oil causes incrustation. A surprisingly small quantity of good oil will give sufficient lubrication to air compressors. Watch your compressor and cut the amount of oil down to the minimum of its requirements. Oil should not be allowed to collect in the machine. In case it does, it should not be allowed to remain, but should be drawn off immediately.

Even when using the best oil, properly fed to the cylinder, the machine should be cleaned frequently or when needed.

Do not use kerosene for cleaning! It is very dangerous. Kerosene has a flash point of about 120 degrees F. and the temperature of the compressed air may at any time reach 300 to 450 degrees F. and cause an explosion. The best and safest method of cleaning is to feed into the air cylinder, soapsuds, made of one part soft soap to 15 parts clean water. Feed a liberal amount of this solution into the cylinder instead of the oil for a few hours or even for a day, if necessary. The accumulation of this water and oil should be drained off from time to time during the process by opening the blow off valve at the receiver.

To prevent rusting, it is necessary to run the machine and feed oil into the cylinder for an hour or so after the cleaning process is completed and the water drained off, so that the valves and all parts connected with the cylinder will become coated with oil before shutting down the machine.

The temperature of the discharged air should never exceed 250 degrees F. The machine should be watched and if the temperature exceeds the above it should be shut down and cooled. If possible the cause of overheating should be eliminated before starting up again.

The temperature increases as the pressure increases; therefore it would be well to equip all air compressors with an automatic pressure or temperature regulator, which will allow the compressor to run idle as soon as the pressure or temperature in the receiver reaches a predetermined limit and likewise bring the compressor into action again as soon as the pressure or temperature falls below this limit. There are regulators on the market which apply to compressors coupled direct to the engine, driven by electric motors, by belt or otherwise.

As an extra precaution a fusible plug may be placed in the discharge pipe near the compressor. This plug should be made to fuse and blow out at a temperature of between 325 and 350 degrees F.

Proper construction, proper care of the machine, high grade lubricants, may save life, and are cheaper than shut downs, lost power, property destroyed, damage suits.

NEW BOOK

Air Compression and Transmission. By H. L. Thorkelson, Associate Professor of Steam and Gas Engineering, University of Wisconsin. McGraw-Hill Book Company, New York. 219 pages 6 by 9 inches, 144 cuts, various tables, etc. Price $2.00.

This book follows closely the lines indicated by its title. It has nothing to do with the various applications and employments of compressed air, which leaves an opportunity for a succeeding volume. The principles involved in practical air compressing are elucidated, the various compressing systems are described and illustrated, also the means for measuring air in use, the speeds of transmission, pipe capacities, etc. The book is not all original, but the sources are generally indicated.

SHOP VENTILATION AND DUST COLLECTION

The following orders are put out by the Industrial Commission of Wisconsin.

EMERY WHEELS.

All grinding, buffing and polishing wheels, except wheels where water is applied at the point of grinding, must be equipped with a hood. The hood must cover the wheel in such a manner that it will carry off the dust insofar as the character of the work will permit. On grinding, buffing or polishing wheels 4 in. or less in width, the width of hood must be 6 in. On grinding, buffing or polishing wheels over 4 in. in width the maximum width of hood must never be less than 2 in. nor more than 3 in. wider than the width of the wheel.

The suction in the connection to the hood must be sufficient to displace a column of water in a U-tube, 5 inches. The test for suction with the U-tube must be a static test and must be made in the following manner: A hole ⅛ in. in diameter must be made in the suction pipe approximately 12 in. from the connection to the hood. The rubber hose at-

tached to the U-tube must be placed over the ⅛-in. hole and the test made under these conditions. When the water in the U-tube stands at 0, the 5-in. displacement is secured when one column of water rises 2½ in. above 0 and the other column of water falls 2½ in. below 0.

All branch suction pipes must enter the main pipe in the direction of the flow of air and at an angle not exceeding 45 deg. measured from a line drawn parallel with the current of air in the main suction pipe. All bends, turns and elbows in suction and discharge pipes must be made with smooth interior surfaces and the radius of the curvature of the elbows on such pipes, measured from the center of the pipe, must not be less than twice the diameter of such elbows.

The dust discharged from any exhaust system must be taken care of by a dust collector, air washer or other adequate system which will prevent it from contaminating the air in or around the place of employment.

SANDBLASTS.

All sandblasting operations, not performed under an inclosed hood, must be performed in a special room set aside for that purpose. This room must be equipped with an exhaust system which shall change the air in the room not less than four times per min. The employer must furnish the employees who are working in sandblast rooms with a suitable covering for the face, which will protect the eyes, nose and mouth; such protector should be worn by the employee when working in the sandblast room. All tumbling barrels and rattlers must be equipped with an exhaust system, which will remove all particles of dust which are light enough to float in the air. All machines which create and throw off dust sufficiently light to float in the air, must be equipped with an exhaust system so designed and attached that it will carry off the dust insofar as the character of the work will permit.

FORGES, FOUNDRIES, ETC.

All furnaces and forges which emit gas or smoke in such quantity as to be irritating, obnoxious, or injurious to health, must be equipped with a ventilating system which will remove as much of the gas and smoke as the character of the work will permit. In all places of employment where the heat or humidity, as a result of the work done, is such as to be injurious to health, a means of ventilation must be provided which will reduce the heat or humidity to as reasonable a degree as the nature of the work will permit. Where the air is so dry that it is injurious to the health it must be properly humidified.

All foundries, forge shops, round-houses and other places of employment in which smoke, gas, dust or vapors are present in sufficient quantities to obstruct the vision, or to be irritating, obnoxious, or injurious to the health, must be equipped with a system of ventilation which will eliminate such smoke, gas, dust or vapors, insofar as the conditions of the industry will permit.

Such system of ventilation must change the air in the room not less than twice each hour, and must supply the room with an additional amount of air to make up for the loss of oxygen which is consumed by the fires. Each person in the room must be supplied with not less than 1,800 cu. ft. of fresh air each hour. The above standard of ventilation for foundries and forge shops can be secured with proper window space on the sides, sufficient height of roof, and with adequate lantern provisions in the roof.

CUBIC FEET OF AIR REQUIRED.

All rooms in places of employment where there is less than 900 and more than 300 cu. ft. of air space per person, and in which there is no smoke, gas, fumes, dust, vapors, or fires consuming oxygen, must be provided with a ventilating system which will furnish 1,800 cu. ft. of fresh air per hour to each person. In all rooms specified above, where there are lights or fires which consume oxygen, an additional amount of air must be supplied to make up the loss of oxygen.

All rooms in places of employment where there is 900 cu. ft. of air space per employe, and in which there is no smoke, gas, fumes, dust, vapors, or fires which consume oxygen, must be provided with a ventilating system which will change the air in the room not less than twice each hour. Such system must be so designed as not to produce injurious drafts or reduce the temperature materially below the average temperature maintained.

It has been found that in rooms where the employes are engaged in active work, a temperature of 60 to 65 deg. is the best standard to maintain. In this temperature the men are invigorated and are less likely to catch cold

when they go out of doors. In rooms where the employes are engaged in sedentary occupations, it has been found that a minimum temperature of 68 deg. is advisable.

In all places of employment not less than 300 cu. ft. of air space must be provided for each person.

FIG. 1. PNEUMATIC HYDRAULIC HOISTS.

PNEUMATIC HYDRAULIC JACKS

The Watson Stillman Company, 50 Church St., N. Y., the well known manufacturers of hydraulic lifts, jacks, presses, etc., are putting out an interesting line of portable pneumatically operated hydraulic lifting jacks especially for railroad shops. As these shops have a working supply of 80 to 100 lb., connection may be had by hose anywhere, the air operating a pneumatic motor which is a part of the

FIG. 2.

equipment, this motor driving a pump which supplies the water pressure by which the lift is actually made, with a positive movement and the concentrated force which the air could not give. These jacks are made in various styles and sizes. Fig. 1 shows a telescopic jack with a lift of 7 ft., while Fig. 2, also telescopic, work in places where the vertical space is limited.

PRECAUTIONS AGAINST GAS ACCUMULATIONS IN TUNNEL DRIVING

Large quantities of gas were encountered during the cutting of the aqueduct tunnel, 19,560 ft. long, through the Santa Ynez range (California) for the water supply of Santa Barbara, and in order to dispose of this inflow, electric arcs were used to ignite the gas after firing shots in the heading. Specially designed open lamps were placed about 200 ft. apart in high points along the tunnel up to 150 ft. from the heading. Half an hour after blasting the arcs were switched into circuit (an ammeter at the switch indicating whether the arcs lighted or not). After switching on the lamps controlled from the tunnel mouth, the foreman and a mate advanced to another arcing station 3,500 ft. from the portal, and again switched on current. If no gas explosion occurred, the tunnel ahead was explored with safety lamps, and if no "pockets" were discovered, the inspectors returned to the inby station, switched the arcs into circuit, and,

leaving them alight, proceeded to the heading and placed torches at intervals of 100 ft. through the gas section. These torches were kept burning during the next shift, and four hours were occupied in testing before a heading gang was allowed to go on shift after blasting had been performed.

NOTES

The Ingersoll-Rand Company, at its annual meeting April 29, elected President W. L. Saunders chairman of the Board of Directors, a new position. George Doubleday, formerly first vice-president, was elected president. W. R. Grace was made first vice-president and treasurer. George R. Elder was re-elected vice-president and J. P. Grace and Henry Lang were made vice-presidents. F. A. Brainerd was re-elected secretary.

A "note" at page 6828 in our issue for May, reproduced without proper scrutiny from a respectable exchange, stated that a cubic yard of granite weighs exactly three-quarters of a ton, which is absurd. The average weight of a cubic foot of granite is 170 pounds, which would make the weight of a cubic yard 4,590 pounds.

It is estimated that the automobile factories of the United States have been using 3,000,000 gallons of gasoline a year for testing their motors, and that by substituting illuminating gas for this service they will save $1,750,000 a year.

Modern blast-furnaces consume about 40,000 cu. ft. of air per minute, and for each grain of moisture per cubic foot, there enters the furnace 1 gal. of water per hour for each 1,000 cu. ft., that is, if the moisture was 1 gr. per. cubic foot, 40 gal. of water would enter the furnace per hour.

The building of the aqueduct from the Catskills to New York has cost many lives. Since the first pick was swung 200 men have been killed and 3,800 injured, most of the accidents being the result of dynamite explosions. At the present time there are about 11,000 men employed.

With $330,000,000 in subway contracts, a few million more for third tracking and replacing elevated structure, $89,000,000 for the New York Central west side improvements, $15,000,000 for docks, besides the regular city street and building improvements, New York promises to be the mecca and happy stamping ground for contractors for some years to come.

Plans have been filed at Ottawa for a $1,000,000 tunnel under the business section of Vancouver. It will be single track, 19½ feet high, 16 feet wide, 3,800 feet long; average depth below surface, 35 to 40 feet.

Canaries have proved to be the most sensitive animal test of the safety of mine air after explosions. In recent experiments, air containing 0.16 per cent. of carbon monoxide was breathed by a mouse for an hour before effects were seen, but a canaray showed distress in three minutes and fell from its perch in eight. Some miners already carry these birds.

Oxyhydrogen-flame working under water is said to be accomplished successfully by means of a special form of burner recently invented. This burner consists of an ordinary oxyhydrogen burner with the addition of a bell or hood shielding the gas orifice from the water, and a compressed air supply. A bar of iron 2½ in. square was cut through in 30 sec. at a depth of 16 ft. under water, a 12-in. slot was cut in 13-16-in. plate in 1½ min., etc.

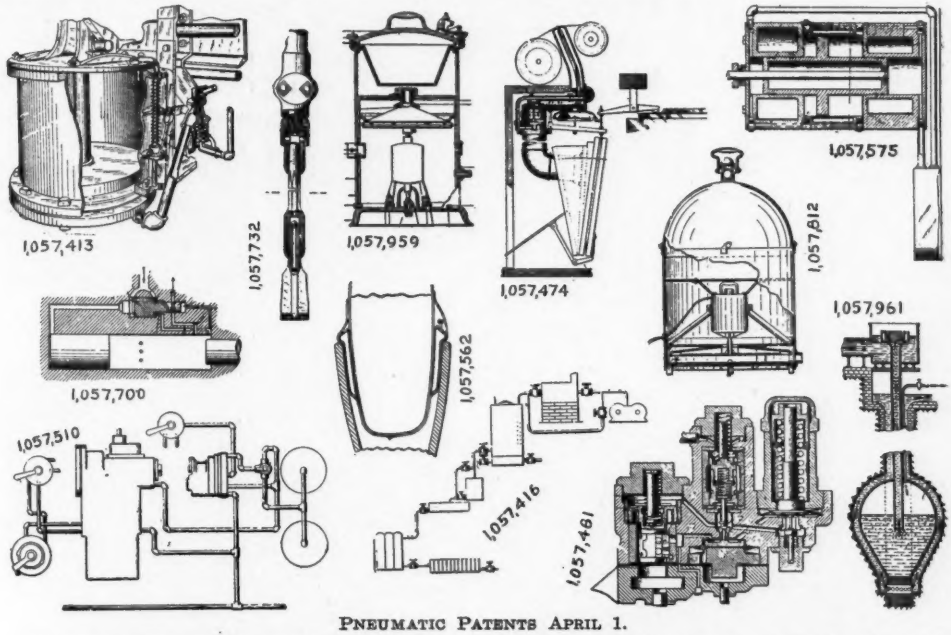
Air as the atomising agent for liquid fuel seems to be replacing steam. It is less convenient to use than steam, but at sea steam runs away with so much water that the make up cost becomes heavy. Steam is believed by some to have a beneficial effect on the combustion of hydro-carbons, but very little that is definite seems to be available. The use of air generally demands an air compressor and a pressure of about 20 lb. or 25 lb. But some systems seem to work with a pressure of only three or four pounds.

A water power plant with a head of 5,412 feet, more than a mile, is under construction near Martigny, Switzerland. Water is taken from Lake Tully; this is near the valley of the Rhone, where the mountain sides descend precipitously all the way to the river. The pipe line will be 2¾ miles long, with inside

diameters of $19^{11}/_{16}$ in., and $25\frac{5}{8}$ in., with thicknesses of from $^{15}/_{64}$ in. to $1^{25}/_{32}$ in. The upper section will be of lap-welded pipe, while the lower sections will be of seamless drawn tube. The construction of the pipe line has been placed with Thyssen & Co. Turbines, for 15,000-hp. capacity, will be built by Piccard, Pictet & Co., of Geneva.

The Linde Air Products Company, an Ohio corporation, has purchased a site at East Seventy-second street and the Lake Shore Railroad in Cleveland, where it plans to begin shortly the erection of a plant on which about $150,000 will be spent for buildings and equipment. The company will manufacture oxygen in tanks for use in cutting and welding by the iron and steel trade. The parent organization has several plants now in operation in various cities and others under construction. It is stated that in addition to the Cleveland plant new factories will be built this year in Boston, St. Louis and Atlanta.

Canadian railways are building or are about to build some important tunnels. There is the tunnel through Mount Royal for an entrance to Montreal, and the 5½ mile tunnel through the Selkirk mountains on which bids were recently opened by the Canadian Pacific Company. But these are small pieces of work as compared with the 15-mile tunnel through Kicking Horse Pass in the Rocky Mountains, which, according to press dispatches, will be placed under construction in the near future by the Canadian Pacific.



PNEUMATIC PATENTS APRIL 1.

LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

APRIL 1.

1,057,413. DUMP-CAR DEVICE. CHARLES H. DOTY and WILLIAM L. BURNER, Columbus, and JOHN M. WILCOX, Cleveland, Ohio.

1,057,416. PROCESS OF CONCENTRATING SULFITE WASTE LIQUOR. CARLETON ELLIS, Montclair, N. J.

1,057,474. PNEUMATIC ACTION FOR MUSICAL INSTRUMENTS. MORRIS S. WRIGHT, Worcester, Mass.

1,057,481. SYNCHRONOUS PRESSURE-CONTROLLING DEVICE. CLYDE C. FARMER, Chicago, Ill.

1,057,497. HIGH-SPEED BRAKE APPARATUS. ROBERT A. PARKE, Parke Mines, Ontario, Can.

1,057,509. COMBINED AUTOMATIC EMERGENCY AND INDEPENDENT BRAKE APPARATUS. WALTER V. TURNER, Edgewood, Pa.

1,057,519. PROCESS OF PRESERVING MILK. CHARLES H. ATKINS, Springfield, Mass.

The process for preserving and handling milk which consists in freely pouring into a container open to the atmosphere a quantity of milk of less volume than the capacity of the container, then closing the container and introducing therein *air under sufficient pressure* to provide and maintain an excess air-pressure within the container, then subjecting the sealed container and contents to a sufficiently high temperature for a sufficient length of time to prevent the subsequent development of living organisms therein, and finally removing the liquid contents of the

container while in an inverted position whereby the excess air-pressure will insure the complete expulsion of the entire liquid contents and still leave the container wholly filled with sterile air to maintain the inside walls of the container sterilized for refilling purposes.

1,057,562. PNEUMATIC CUSHION FOR STUMP-LEGS. JOSEPH G. LA POINT, New Albany, Ind.

1,057,575. AIR-COMPRESSOR. EDWARD MURPHY, Ennis, Tex.

1,057,700-1. VALVE-MOTION FOR PERCUSSIVE TOOLS. LEWIS C. BAYLES, Easton, Pa.

1,057,732-3. ROCK-DRILL. CHARLES C. HANSEN, Easton, Pa.

1,057,812. VACUUM-CLEANER. JOHN J. DUFFIE, San Francisco, Cal.

1,057,959. VACUUM-PUMP. WALTER A. HEARN, Baltimore, Md.

1,057,961. HYDRAULIC AIR-COMPRESSOR. CARL HEIRICH, Cologne, Germany.

1,058,491. AIR-COMPRESSOR FOR BLOWING ORGANS. HUGH SWANTON, Philadelphia, Pa.

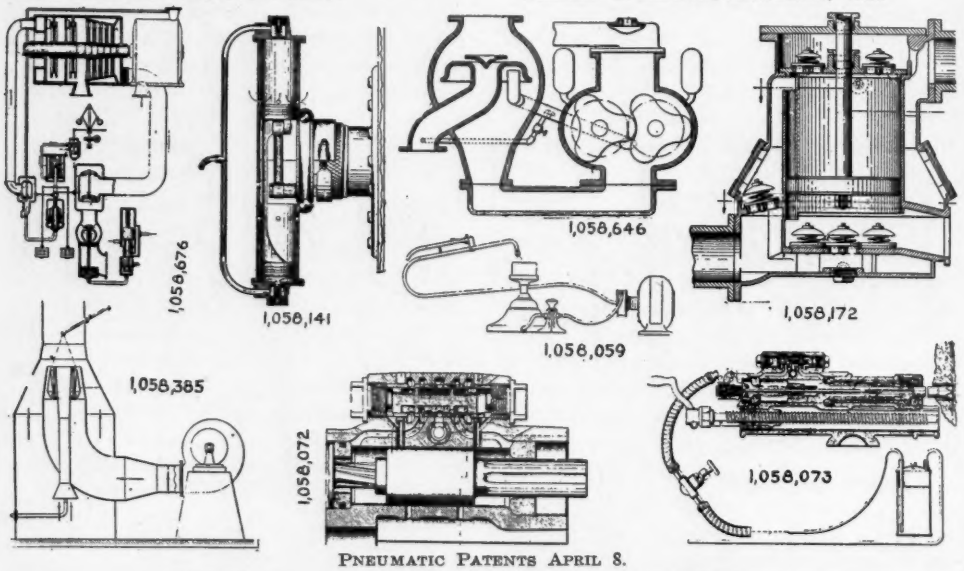
1. An air compressor for blowing organs comprising a series of spaced, separate rectangular fan casings, adjacent casings, having communication with one another, a connecting chamber of rectangular configuration for establishing such communication, one end casing having an air inlet port therein, and the other end casing having an air outlet port therein, a fan operative within each casing and a non-conducting sound screen of corrugated porous material operatively fitted across the respective ports.

1,058,646. CONDENSER AIR-PUMP. ROYAL D. TOMLINSON, Milwaukee, Wis.

1,058,676. TURBO - COMPRESSOR - GOVERNING MECHANISM. JEAN ALEXANDRE REY, Paris, France.

APRIL 15.

1,058,706. SHEET-FEEDING MECHANISM. WILLIAM S. AMIDON, Milwaukee, Wis.



PNEUMATIC PATENTS APRIL 8.

APRIL 8.

1,058,059. APPARATUS FOR CASTING METALS. GEORGE A. HOWE, Pittsburgh, Pa.

1. In apparatus of the character described, an investment holder, a blow-pipe, and means intermediate said parts and connected thereto for supplying air under pressure to the blow-pipe, said means receiving its air supply through the investment holder or independently thereof at will.

1,058,072. ROCK-DRILLING ENGINE. JOHN GEORGE LEYNER, Denver, Colo.

1,058,073. WATER-CONVEYING APPARATUS FOR EJECTING ROCK-DRILLINGS FOR ROCK-DRILLING ENGINES. JOHN GEORGE LEYNER, Denver, Colo.

1,058,074. VALVE MECHANISM FOR ROCK-DRILLING ENGINES. JOHN GEORGE LEYNER, Denver, Colo.

1,058,136. PRESSURE-RETAILING MECHANISM FOR FLUID-PRESSURE BRAKES. CLAUDE A. BAKER, Mitchell, Ind.

1,058,141. PUMPING ATTACHMENT FOR AUTOMOBILES. OSCAR M. BERGSTROM, Minneapolis, Minn.

1,058,172. AIR-PUMP. BURT O. GAGE, Warren, Mass.

1,058,385. MECHANICAL DEVICE FOR CREATING FORCED DRAFT. JULES PRAT, Paris, France.

1,058,817. STATION-INDICATOR. HOMER S. VOTAW, Laurier, Wash., and HARRY GLENN COULSON, Portland, Ind.

1. In an indicator of the class described, a ribbon, spaced drums on which said ribbon is oppositely wound, means for oppositely and independently rotating the drums, said means including a cylinder, a fluid operated piston contained in said cylinder and operatively connected to the drums, an exhaust tube for the cylinder having an enlarged end, a valved connection controlling the supply of fluid to the cylinder, an inclosed piston connected with the valve, a port connecting said inclosure and enlarged end of the exhaust tube whereby the exhaust will cause a suction in the piston inclosure last mentioned tending to close the supply valve and means for admitting fluid behind the last mentioned piston to shift the same and close the valve carried thereby.

1,058,847. PNEUMATIC MOTOR. WILLIAM F. COOPER, Norwalk, Ohio.

1,058,900. CACTUS-BURNER. ALEX PLOCH, Carpenter, Tex.

1. In a cactus burning device comprising a liquid fuel tank, means for supplying air under pressure to the tank, a discharge pipe for the tank, means for controlling the flow through the discharge pipe, a pipe of resilient metal secured on the end of the discharge pipe and having a plurality of elongated loops, a transversely

extending burner secured to the end of the loops, and having a discharge aperture formed in one side thereof, and a frusto conical shield member frictionally engaged on the loops.

1,059,038. FLUID-CONTROL SUPPLY-VALVE FOR FLUSH-TANKS. EDWARD G. COOK, New York, N. Y.

1. In a device of the character described, a tank, a water inlet pipe in the tank, a cylinder at the upper portion of the tank, a piston working in said cylinder, a valve seat in the water inlet of the cylinder, a valve controlling said seat, means connecting said valve with said piston whereby the movement of the piston will open and close the valve, and a conduit leading from the said cylinder between the closed end and said piston down through the tank with its extremity open and located a considerable distance below the water line of the tank, whereby the rise of the water in the tank will *compress the air in* the conduit and cylinder to advance the piston and close the said valve when the water reaches a certain pre-determined level.

1,059,085. SAND-PUMP. ALBERT V. STEELE, Bedford, Ind.

1,059,428. PNEUMATIC COUNTERSINKING-MACHINE. JAMES H. BONDY, Great Falls, Mont.

1,059,539. ROCK-DRILL. CHARLES A. HULTQUIST, Bisbee, Ariz.

1,059,549. PNEUMATIC ACTUATING UNIT. NELS MAGNUNSON, Fort Wayne, Ind.

1,059,563. WATER ATTACHMENT FOR DRILLING-MACHINES. CHARLES B. RICHARDS, Cleveland, Ohio.

1,059,584. APPARATUS FOR DECOMPOSING OXIDS OF NITROGEN AND THE LIKE. PAUL WINAND, Cologne, Germany.

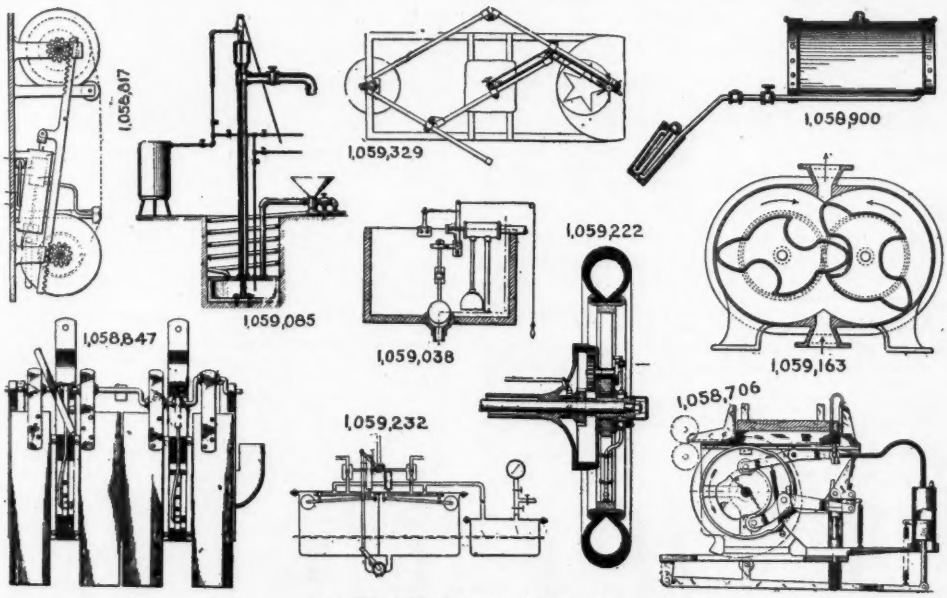
1,059,645. PNEUMATIC CARPET-CLEANER. LOUIS F. ST. ANTHONY, Worcester, Mass.

1,059,658. PNEUMATIC STACKER. GEORGE F. CONNER, Port Huron, Mich.

1,059,661. MANUFACTURE OF PORTLAND CEMENT. THOMAS A. EDISON, Llewellyn Park, Orange, N. J.

5. The process of manufacturing Portland cement, which consists in fusing silicious and aluminous materials with limestone in such proportions as to result in fusion at a temperature less than 2500 degrees Fahr. and the production of an extremely liquid non-viscid slag containing approximately 50 per cent. of lime, in subjecting the fluid slag to *a powerful blast* whereby it will be chilled and finely subdivided, in adding sufficient limestone to complete the final proportion of lime desired for the cement, and in finally calcining the mixture, substantially as set forth.

1,059,802. CENTRIFUGAL FAN. EUGENE B. WILLIAMS, Boston, Mass.



PNEUMATIC PATENTS APRIL 15.

1,059,161. BLADE FOR THE WHEELS OF ROTARY FLUID-COMPRESSORS. ALBERT HUGUENIN, Zurich, Switzerland.

1,059,163. ROTARY BLOWER. ALEKSANDER JENDRUSIK, Dabrowa-Gornicza, Russia.

1,059,207. PNEUMATIC TIRE AND ARMOR THEREFOR. JAMES A. POSEY, Waxahachie, Tex.

1,059,222. AIR-PUMP. CHARLES MACK SCOTT, San Angelo, Tex.

1,059,232. HYDRAULIC COMPRESSOR. GUSTAV SUIDA, Vienna, Austria-Hungary.

1,059,324. PNEUMATIC ATTACHMENT FOR PIANOS. WILLIAM A. WATSON, Medford Hillside, Mass.

1,059,329. BLOWPIPE APPARATUS. WORTHY C. BUCKNAM, Jersey City, N. J.

APRIL 22.

1,059,367. METHOD OF AND APPARATUS FOR BESSEMERIZING COPPER MATTE. HOWARD B. JERNEE, Perth Amboy, N. J.

1,059,373. SPRAYING DEVICE. WILLIAM T. KING, Minneapolis, Minn.

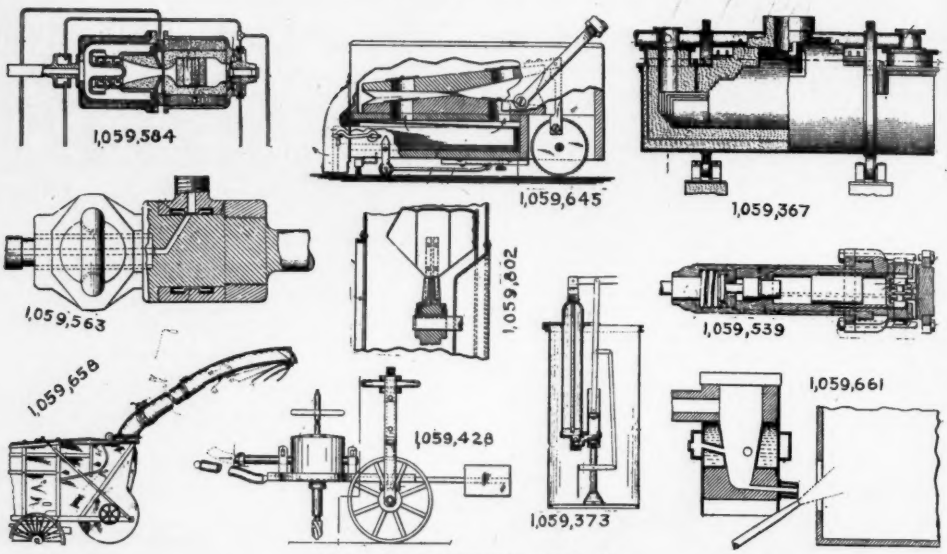
APRIL 29.

1,059,976. SYSTEM FOR PURIFYING, HUMIDIFYING, AND CONTROLLING THE HUMIDITY OF AIR. WILLIS H. CARRIER, Buffalo, N. Y.

1,060,012. FLOAT-VALVE FOR CENTRIFUGAL COMPRESSORS. FRED E. NORTON, Lynn, Mass.

1,060,030. VALVE STRUCTURE. JOSEPH SCHWERTNER, New York, N. Y.

5. A pneumatic valve structure for musical intruments or the like, comprising a relatively fixed member and a relatively movable member fulcrumed thereto intermediate their ends, and a



PNEUMATIC PATENTS APRIL 22.

flexible membrane extending from one member to the other to form a bellows on each side of the fulcrum, one bellows being larger than the other whereby with the same pressure in both the larger bellows will predominate, both of said bellows being tapered off along both members away from the fulcrum.

1,060,102. METHOD OF CONVEYING WARM LIQUIDS. HEINRICH KOPPERS, Essen-on-the-Ruhr, Germany.

1,060,125. FLUID-OPERATED ENGINE. ENOCH RECTOR, New York, N. Y.

1,060,127. VALVE FOR JARRING-MACHINES. ROBERT FRANKLIN RINGLE, Zelienople, Pa.

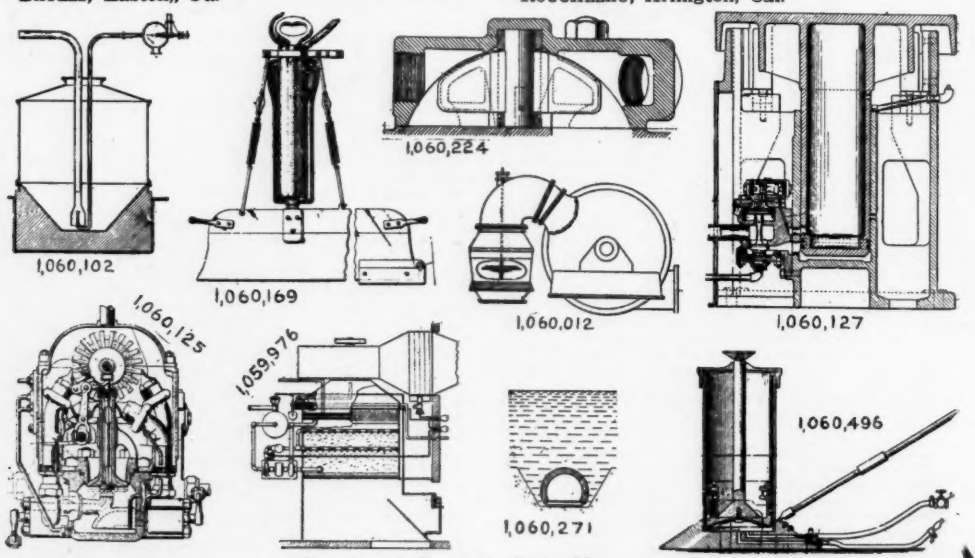
1,060,169. PNEUMATIC HOG AND CATTLE SPLITTER. EMIL DEMOULIN, National City, Ill.

1,060,224-5. PERCUSSIVE TOOL. LEWIS C. BAYLES, Easton,, Pa.

1,060,271. METHOD OF BUILDING SUBAQUEOUS TUNNELS. DUNCAN D. MCBEAN, New York, N. Y., and HENRY M. CHANCE, Philadelphia, Pa.

1. A method of constructing subaqueous tunnels which consists in building the main body of such tunnel, or the main body of a section thereof, at the surface so constructing said structure as to permit of its use as a working chamber adapted to retain air under pressure; floating said structure into place and sinking it into the desired position upon the proposed site of the tunnel and maintaining air under pressure in said structure, whereby a working chamber is formed which is bounded by the inner surfaces of said structure and by the surface of the material upon which the tunnel is to be constructed, and completing the construction of said tunnel, or of said section thereof.

1,060,496. COMPRESSED-AIR JACK. LOUIS J. ROUCHLEAU, Arlington, Cal.



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